

# STRATEGIES FOR IMPROVING CRITICAL ENERGY INFRASTRUCTURE

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## HEARING

BEFORE THE

### SUBCOMMITTEE ON GOVERNMENT OPERATIONS AND BORDER MANAGEMENT

OF THE

### COMMITTEE ON HOMELAND SECURITY AND GOVERNMENTAL AFFAIRS UNITED STATES SENATE ONE HUNDRED SEVENTEENTH CONGRESS

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# STRATEGIES FOR IMPROVING CRITICAL ENERGY INFRASTRUCTURE

WEDNESDAY, OCTOBER 27, 2021

U.S. SENATE,  
SUBCOMMITTEE ON GOVERNMENT OPERATIONS  
AND BORDER MANAGEMENT,  
OF THE COMMITTEE ON HOMELAND SECURITY  
AND GOVERNMENTAL AFFAIRS,  
*Washington, DC.*

The Subcommittee met, pursuant to notice, at 2:30 p.m. via Webex, Hon. Krysten Sinema, Chairman of the Subcommittee, presiding.

Present: Senators Sinema, Carper, Padilla, Ossoff, Lankford, Hawley, and Portman.

## OPENING STATEMENT OF SENATOR SINEMA<sup>1</sup>

Senator SINEMA. The Subcommittee will come to order. I welcome Ranking Member Lankford, Members of the Committee, and our witnesses today. We are examining strategies for improving critical energy infrastructure in the United States. This topic represents a key issue for Arizona, Oklahoma, and the rest of the Nation. Our businesses, communities, and families need a reliable energy grid to succeed.

However, this past year has brought severe weather and storms to every corner of our country, leaving families victim to the elements when the electrical grid goes dark. These outages present a financial cost to American families and businesses, with the American Society of Civil Engineers (ASCE) estimating that power outages cost U.S. data centers \$8,851 for each minute of a disruption, and that the cost of each outage results in \$42,000 in losses for the manufacturing sector. These outages also lead to deaths, and when sometimes grid failure is unavoidable, one death is too many.

I support an all-of-the-above energy approach that maintains reliability, affordability, and safety, and that is why I was proud our bipartisan infrastructure package includes funding for grid infrastructure, resiliency, and reliability. New money to support supply chains and clean energy technology, including battery research and manufacturing, and investments in fuels and technology infrastructure, including carbon capture, utilization and storage (CCUS), hydrogen research and production, a civil nuclear credit program, and hydro power efficiency incentives.

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<sup>1</sup> The prepared statement of Senator Sinema appears in the Appendix on page 41.

Finally, we were able to make the Federal Permitting Improvement Steering Council (FPISC) permanent and expand access to Tribes, Alaska native corporations, and Hawaii native organizations, so projects that improve America's energy infrastructure can be completed without needless delay.

In Arizona, we are proud of the progress our utilities have made to utilize cleaner energy sources. My State has been a leader in integrating demand response into the grid, which has been a key component in maintaining grid operations and affordable pricing during the increasingly hot summers of the past 2 years.

Arizona also has the highest solar potential in the Nation, and I have supported the growth of the solar industry and the economic opportunities it brings to Arizonans. However, I recognize the challenges an intermittent resource like solar can present, and that is why I support increased investments in battery storage and implementing technologies that enhance grid flexibility and resilience.

By utilizing these programs, such as the Permitting Council, and funds made available through our bipartisan work to improve America's infrastructure, we can make sure that extreme weather events do not cost Americans money, and more importantly, that a grid failure does not result in death.

I look forward to hearing from our witnesses, and now I will call on Ranking Member Lankford for his opening statement.

[Pause.]

It looks like we may not have Ranking Member Lankford with us yet, so I would like to turn to Ranking Member Portman for his opening statement.

#### **OPENING STATEMENT OF SENATOR PORTMAN**

Senator PORTMAN. Great. Thank you so much, Senator Sinema, and Senator Lankford is coming soon, I think, and to both of you we appreciate you holding this subcommittee hearing on a really important topic. It has been great to work with you on these issues. Our energy infrastructure is so critical, and as you say, it is under threat so much now, particularly with all the natural disasters.

We worked together on broader infrastructure issues—roads, bridges, and so on—but we also need to think about our energy infrastructure and be sure it is able to deliver that reliable and affordable energy to our homes and our communities, which our national security depends on, certainly our economic prosperity depends on.

Senator Sinema and I, along with eight of our colleagues partnered on this bipartisan Infrastructure Investment and Jobs Act. Senator Carper and others were very involved in this. It does provide a \$65 billion investment into our energy infrastructure and our electric grid.

The larger bill includes something else that I think is very important and I know will be a topic at today's hearing and that is how to ensure that as we are moving forward with energy infrastructure we are doing it in a more cost-effective way, so the Federal dollar can be stretched further.

Along those lines, Senator Sinema and I introduced what is called the Federal Permitting Reform and Jobs Act earlier this. It basically lifts the sunset on a program that has been in place for

the last several years that has worked very well. We made that program permanent. It is called Fixing America's Surface Transportation Act (FAST-41), referring to the FAST Act, which was the service transportation bill.

Title 41 of it is a proposal that Senator McCaskill, out of this committee, and I worked on back in 2014 and 2015. It is a common-sense way to bring agencies together at the start of a permitting process for some of our largest infrastructure projects to develop a transparent timeline, hold them accountable to it. It also establishes the Federal Permitting Improvement Steering Council.

By the way, one of our witnesses today I see, Madam Chair, is Alex Herrgott, who was Executive Director of that group, and he continues to work on these issues.

The notion is to help resolve conflicts between agencies on projects and develop permitting best practices, speeding up permitting, not going around the permitting requirements but doing so in a much more cost-effective way. And because the system has been so complicated, that is easy to do.

I will give you one example of this. The FAST-41 programs have reduced the National Environmental Policy Act (NEPA) review process from 4.5 years, on average, to 2.5 years, on average, for covered projects. By the way, that is a 45 percent savings which represents billions of dollars in savings.

This is one thing that is working in our Federal Government, faster, more effective permitting, green-lighting projects, and particularly for energy infrastructure this has been critical. Again, it does too without reducing any environmental or safety standards.

The Senate passed a larger infrastructure bill, of course, with 69 votes way back in August, more than two and a half months ago. Our hope is that even in the next few days we may see the legislation pass the U.S. House of Representatives. I certainly hope so, because it is critical to fixing our crumbling infrastructure and strengthening our economy. But again, it also fixes our nation's core infrastructure, including energy infrastructure, without raising taxes or adding to inflation, while helping our economy grow in the long term.

I really appreciate you holding the hearing today, and to you and Senator Lankford, it is always a pleasure to work with both of you. My hope is that we will get in some good Q&A today with some of your witnesses and learn more about how we can improve our critical energy infrastructure.

Thank you, Madam Chair.

Senator SINEMA. Thanks so much, Ranking Member Portman.

I believe that Ranking Member Lankford is back on after some technical difficulties. Ranking Member Lankford, if you are back on I would like to turn the time to you for an opening statement.

[Pause.]

No. We will come back to him when his technical difficulties are done.

We are going to go ahead and start by swearing in our Committee. It is the practice of this Committee to swear in witnesses. All of our witnesses today, if you will please stand and raise your right hand.

Do you swear that the testimony you give before this Committee will be the truth, the whole truth, and nothing but the truth, so help you, God?

Mr. HERRGOTT. I do.

Mr. YONKER. I do.

Mr. ESQUERRA. I do.

Mr. NICKELL. I do.

Mr. BRYCE. I do.

Senator SINEMA. Thank you.

We will now hear from our witnesses. I will ask each of our witnesses to keep their remarks to 5 minutes. Your full written statements will be entered into the hearing record.

Our first witnesses is Alex Herrgott. Mr. Herrgott is the President and Chief Executive Officer (CEO) of The Permitting Institute. He was the first Executive Director of the Federal Permitting Improvement Steering Council and is a former Deputy Staff Director of the Senate Committee on Environment and Public Works (EPW).

Welcome, Mr. Herrgott, and you are recognized for five minutes.

**TESTIMONY OF ALEX HERRGOTT,<sup>1</sup> PRESIDENT AND CHIEF FINANCIAL OFFICER, THE PERMITTING INSTITUTE**

Mr. HERRGOTT. Thank you. Chairman Sinema and Ranking Member Lankford, my name is Alex Herrgott, and I serve as the President of The Permitting Institute, a nonpartisan, nonprofit organization focused on simplifying the permitting process so we can rebuild, expand, and modernize America's aging infrastructure while preserving our environmental, cultural, and historic resources.

While we are based here in Washington, D.C., The Permitting Institute's most important work happens across the country, in the field, in Arizona, in Ohio. We help our members navigate an overly complicated process, work with you on achievable reforms, and train the next generation of government regulators and project developers.

Unfortunately, volatility in our energy markets continues to increase as we transition from conventional to renewable energy sources, and much of the energy infrastructure required to head off an emerging energy crisis this winter remain idle in various stages of planning and development. This mismatch of supply and demand is responsible for the rapidly increasing cost of energy. Nearly half of all Americans rely on natural gas to heat their homes, and as we all are aware, the price of natural gas has nearly doubled since the beginning of the year and is expected to jump even higher this winter.

Rising energy costs have placed a spotlight on new, clean, affordable, and reliable sources of energy and transmission. The hundreds of new projects to meet this imperative, many of which are shovel-ready, must routinely overcome a maze of permitting obstacles which developers report add 20 to 30 percent of project costs, costs that are passed on in the form of higher taxes and escalating utility rates. Nobody wins under the current system—not the envi-

<sup>1</sup> The prepared statement of Mr. Herrgott appears in the Appendix on page 43.

ronment, not the distressed U.S. electricity grid, not the rate payers, and not the vulnerable communities who can least afford it, the small businesses, the farmers, the manufacturers, and the American families that ultimately bear the burden.

Project developers, including many of our members, stand ready to pursue \$600 to \$800 billion in private investment for new wind, solar transmission storage and carbon capture. That is 200–300 gigawatts of new utility-scale renewable energy generating capacity, enough to power 30 million homes.

The reality, however, is the benefits of projects initiated today will not be realized for 7 to 10 years because of the current permitting process. This includes billions in new offshore wind projects that are ready to go, but yet to receive their preliminary permitting timetable. Also proposed onshore renewable energy projects, largely in Arizona, Nevada, and the West are also on hold as Bureau of Land Management (BLM) staffing decreases and other key issues keep projects in limbo to the point where inaction serves as a de facto rejection. Once these projects do begin the formal process, many still are snarled for years in bureaucratic and legal gridlock.

One telling example is a \$3 billion investment in a clean energy transmission line that began the permitting process more than a decade ago. It underwent 7 years of review and it was finally deemed complete by the Federal Government 4 years ago. However, it is now entangled in court proceedings because one of the 49 participating agencies pursued a separate, programmatic workflow that renders the prior approval for this project moot, all because agencies in the same department did not know what the other were doing. This is not a Republican or Democrat issue. This is a process issue.

The unpredictable permitting process is the enemy of progress, and that uncertainty is keeping hundreds of billions of new U.S. investments from getting off the sidelines and investing in more cost-efficient and next-generation infrastructure, which I know Chairman Sinema and Ranking Member Portman have spent a tremendous amount of time trying to reverse. This also limits the impact of any new public spending that we may see from an emerging infrastructure package.

The Permitting Institute is building a large coalition of diverse entities, committed to achieving a balance between progress and protection. We are working with developers in every affected industry sector, officials at all levels of government, tribes, nongovernmental organizations, and community leaders to identify common goals that deliver permitting wins. But to achieve this balance we must untangle the web of the overlapping regulatory and statutory requirements, some enacted over 50 years, that are in critical need of modern revision.

To achieve a greater coordination and efficiency is not limits on public stakeholder participation or shortcuts to laws and regulations. More comprehensive and lasting reform efforts in the past have been blocked by the notion that faster means fewer protections for the environment. This notion is simply false. There are no steps skipped for these highly scrutinized reviews for these large, complicated projects. Project developers must always comply with

all the relevant environmental statutes. There are no shortcuts, just avoidable process delays.

To overcome this political impasse to progress, Congress can start small, with a 7-year pilot program to test innovative policies on a targeted list of projects critical to our nation's energy needs. This temporary new authority will create room to experiment with expedited project approvals. Outcomes can be scrutinized by this Committee and others, studied by the whole of Congress for feasibility, and then converted into more lasting reforms.

We should also look to expand local and tribal partnerships and State permitting councils. Earlier this year, The Permitting Institute successfully adopted, in Arizona, the introduction of a State permitting office focused on bridging the trust, communication, and the coordination gap between State and Federal regulators. Thank you, Chairman Sinema.

To be clear, opportunities for progress are directly in front of us. Over the past decade, Congress took the first steps through the creation of the Federal Improvement Steering Council and through the improvements offered in One Federal Decision framework. A confession is good for the soul. This is not enough. We have way more work to do.

To conclude, if we agree that a project development cycle of 7 to 10 years is simply too long, we must move past the fringe talking points and take the next steps together. Doing so, we will unlock the opportunity to modern and expanded energy infrastructure that safeguard communities, protect the environment, and move us closer to President Biden's clean energy goals while simultaneously securing new domestic sources of affordable energy, creating jobs, and bringing American industry to life.

Thank you very much.

Senator SINEMA. Thank you, Mr. Herrgott.

I would like to recognize Ranking Member Lankford for his opening statement. Senator Lankford, I hope that we are good on technical difficulties, so the time is turned to you now.

#### **OPENING STATEMENT OF SENATOR LANKFORD<sup>1</sup>**

Senator LANKFORD. Thank you. I believe we are good on technical difficulties. At some point we will all be able to do face-to-face hearings again, and that will be a good day for that, so thank you. Thank you, as well, to Chairman Sinema for holding this hearing. It is incredibly important for grid reliability. We have to be able to make sure we have adequate energy supply.

As many of you may know, last year, in Oklahoma and much of the country, especially in all of the Plains area, in the Midwest faced unseasonably extremely cold weather and all the winter precipitation that challenged our grid and energy supply left many people in the dark, in the coldest time of the year, last February.

I frequently say that Oklahoma is the Saudi Arabia of winds. About 40 percent of our electricity comes from wind annually. During that period of time last February, the supply power of our wind infrastructure, wind fell off the grid like a switch had been flipped.

<sup>1</sup> The prepared statement of Senator Portman appears in the Appendix on page 42.

Meanwhile, coal, which usually is less than 20 percent of our generation, shot up to provide over 50 percent of our power.

Oklahoma is truly an all-of-the-above energy State. We have wind. We have solar. We have hydroelectric. We have geothermal. We have diesel. We have natural gas. We have coal. It is very important to us to be able to maintain that type of energy diversity for us, and I am very interested in the issues that happened last year, where we have weaknesses in our system, and how we can actually learn from that.

There is a lot that we still need to be able to go through in the days ahead. As I am watching what is happening in other parts of the world, right now, for instance, in the United Kingdom (UK), their prices of energy have shot up dramatically. They are reducing reliability. What is happening in California right now, they are having reliability issues. Even China is battling an energy crisis right now, where they are dropping their energy usage across all of China and trying to be able to deal with certain provinces only certain days that they can actually use power.

This is a very significant issue that is happening worldwide, and I want to be able to track and see how we in the United States can make sure that we can maintain power, maintain reliability for the protection of human life on very cold and very hot days, but also for consistency and actual economic development, manufacturing, all the things that are also important to us.

There has been some consideration for renewable energy tax credits. What that looks like in the days ahead, we will have an opportunity to be able to talk through some of those things. As I have already heard mentioned, some of the permitting issues that are out there are very significant because none of these projects begin and end in a year. We have to be able to deal with basic distortions in our systems as we look on the horizon and see how we are over-accomplishing in some areas and not using some others for our energy development.

All these are issues I hope to be able to address today as we deal with the responsibility that this particular Subcommittee has on energy diversity for our nation and how we can protect our nation and our economy with a diverse energy portfolio, to make sure that that is stable.

So, Chair Sinema, thank you again for leading out on this, and I look forward to the ongoing conversation in the hours ahead.

Senator SINEMA. Thanks so much, Senator Lankford.

I will go on to introduce our second witness, Bryce Yonker. Mr. Yonker is the Executive Director and the CEO for Grid Forward. Grid Forward maintains over 100 members from utilities, technology providers, national labs, investors, nonprofits, universities, and other advanced grid stakeholders.

Welcome, Mr. Yonker, and you are recognized for five minutes.

**TESTIMONY OF BRYCE YONKER,<sup>1</sup> EXECUTIVE DIRECTOR AND  
CHIEF EXECUTIVE OFFICER, GRID FORWARD**

Mr. YONKER. Thank you, Chair Sinema, Ranking Member Lankford, Ranking Member Portman, Members of the Subcommittee for the opportunity. My name is Bryce Yonker and I am Executive Director and CEO of Grid Forward, as you said, an industry organization working to accelerate grid modernization and innovation.

The electric grid is considered the most important engineering achievement of the 20th Century. It is the backbone by which we build and sustain our lives, communities, business, and indeed society. However, we are not investing in the grid nearly enough to meet the demands we place on it.

The Association for Civil Engineers predicts that in less than 8 years we will have underinvested in the grid by about \$200 billion. Should we be surprised by the grid impacts that happened over the last 9 months, from overwhelming events such as winter storms, unprecedented heat, wildfires, a pipeline cyberattack, and major storms that have already been discussed?

National Oceanic and Atmospheric Administration (NOAA) reports that the United States has had 18 climate weather and related disasters so far this year, costing U.S. communities more than \$1 billion in damages each, after record damages of \$100 billion from 22 events last year.

At the same time, market dynamics are changing faster than ever before. Customers are buying into energy options ranging from smart thermostats to electric vehicles. Economics and policy drivers are accelerating energy transition to resources like wind, solar, and batteries rapidly. In the midst of this change, operators are trying to make do with 20th Century assets that in many instances are past their useful lives.

For the last decade, we have helped to promote and accelerate a toolbox of advanced grid applications that are ready to be implemented at scale. I will summarize my remarks in four classes of capabilities: forecasting, monitoring, planning, and deployment.

First, advanced forecasting. Simulation, advanced algorithms, supercomputers, and other technologies are helping us forecast future events depending on a variety of factors. For the electric grid, the industry is getting better at forecasting both supply and demand. Indeed, keeping customer demand and electric supply dynamically in balance is the basic equation for reliable power.

However, outlier events that have been considered statistically improbable are becoming more frequent. For example, the heat dome I experienced in Oregon this summer with temperatures in the 115-degree range, right outside my door here, beat our previous high temperatures by eight degrees. With these events increasing in frequency and impact we need more sophisticated, higher resolution forecasting to keep the grid in balance.

Second, real-time monitoring. Advanced sensing capabilities allow grid operators to see, in near real-time conditions of the grid that previously could only be determined through slow, manual, in-person inspection. Operators can track the health of assets of the

<sup>1</sup> The prepared statement of Mr. Yonker appears in the Appendix on page 50.



grid such as rotting or damaged poles, abnormal electric currents, trees in contact with lines, and much more. We must now move into advanced and automated controls of our electric grid systems so that real-time awareness leads to fast action for enhanced grid reliability.

Third, strategic planning. Today's planning frontier needs to consider such a large number of factors that it must be approached as a living set of contingencies and adaptive strategies. Unfortunately, many, if not most, communities do not have adequate resiliency action plans, let alone installed grid flexibility solutions to adapt to circumstances they are already facing. Grid operators and communities need support to develop broader strategic plans with actionable roadmaps to meet tomorrow's challenges.

Fourth and finally, grid-enhancing deployment. Investing in advanced grid deployments is the foundation of making community resilience a reality. We have recently prepared a briefing that illustrates the benefit from advanced grid deployments ranging from smart grid investments that have brought over \$2 billion of added impacts in one wider community to single grid hardening projects that have decreased outages by 10 percent or more.

I would like to briefly highlight a couple of quick examples, as I know my time is running low. Last week, the CEO of PG&E in California talked about how advanced grid capabilities allowed them to pinpoint high-risk areas that could have prevented 96 percent of the structures that were damaged or lost from previous wildfires.

The Department of Energy (DOE's) own Smart Grid Investment Grants from 2009 to 2013, directly brought nearly \$8 billion of resources to advanced grid capabilities. Many utilities accelerated their grid modernization plans by as much as a decade.

One utility in your home State, Chair Sinema, is working with two military facilities to deploy hardened grid infrastructure, including microgrids, that will significantly increase the reliability of their operations. In a neighboring State to yours, Ranking Member Lankford, smart grid deployments helped lower outage time from one recent storm by an estimated 45 million outage minutes, and my utility here in Oregon is leveraging a portfolio of demand-side distributed assets and market resources alongside grid modernization capabilities to help meet the needs, like on that 115-degree day this summer, where neither I nor very many customers were out of power.

In summary, our electric grid is becoming more complex and so are its challenges. Resilience is no longer a matter of just energy supply. Instead, we must consider the capabilities of all grid-connected resources and look beyond physical capacity. Central to harnessing these interconnected resources is access to and participation in wide markets that enable coordination and maximize their value, a topic I know we are going to talk about today.

However, technology markets and policy or any factors alone will not solve this issue. We believe the bipartisan infrastructure package, passed earlier this year through the Senate, and the Energy Act of 2020 together provide an urgently needed down payment to advance much-needed grid resilience and capabilities. It is critical that Federal resources align with local realities to ensure that our

grid can remain safe, reliable, and affordable. We must also prioritize and ensure that our grid is increasingly flexible, efficient, clean, equitable, secure, and as we are talking about today, resilient.

Thank you for the time, and I look forward to the questions.

Senator SINEMA. Thank you, Mr. Yonker.

Our third witness is Levi Esquerro. Mr. Esquerro is the Senior Vice President of Native American Advancement and Tribal Engagement (NAATE) for the University of Arizona. He has served as Tribal Chairman of the Chemehuevi Indian Tribe, and for three terms as their Tribal Councilmember.

Throughout his career, his focus has been on economic and community development for Arizona's Native Tribes.

Welcome, Mr. Esquerro. You are recognized for five minutes.

**TESTIMONY OF N. LEVI ESQUERRA,<sup>1</sup> SENIOR VICE PRESIDENT  
FOR NATIVE AMERICAN ADVANCEMENT AND TRIBAL EN-  
GAGEMENT, UNIVERSITY OF ARIZONA**

Mr. ESQUERRA. Thank you so much, Senator Sinema. This is a great opportunity and an honor for me to be here today and to share a little bit of my thoughts.

I have been at the University of Arizona for a little over a year, and the very first thing I want to share with you is my first interview with President Robbins he asked me, he said, "Hey, Levi. I would like to work with the Tribes. What can we do?" What I said to him, what I shared with him is, "You know, that is a complex question that is hard to answer." But I said, "If you really want to work with Tribes, it takes three main things. You have to have patience, from patience comes respect, and from respect comes trust."

I know what we are talking about today impacts our Tribal Nations. In Arizona we have 22 Tribal Nations, but throughout the United States there are 570-plus.

I want to let you know that as I shared this with him, one of the things I want to commend you, Senator Sinema, and everyone, is when I started reviewing the Federal Permitting Reform and Jobs Act there is a section in there that they are adding Tribal and Native corporation projects to be eligible for infrastructure projects. This allows Tribes to have the same competitive access to funds that the States have historically benefited from. Kudos to you for doing that. That actually shows that you are actually making progress to not only listening to the Tribes but giving them an equal playing field. I want to commend you on that, because that is not always done.

But in saying that, and after listening to some of the comments—I am deviating from my written testimony just to talk to you a little bit—I have found that one of the biggest struggles I have had in working with my Tribal Nation, Chemehuevi, and others, is sometimes we need to raise our capacity. We might have the desire to do a renewable energy project, but the capacity and the regulations that we have to go through, sometimes it is time-consuming and it is beyond our capacity.

<sup>1</sup> The prepared statement of Mr. Esquerro appears in the Appendix on page 58.

So not only is there a need, we just opened up the opportunity for Tribes to compete with States, right. States have been doing it for years. Tribes, this is going to be their first go-around doing it. We need to raise the capacity, not only of the Tribes themselves but those Federal agencies who are going to interact with the Tribes, so they can see them for the uniqueness that they are but the opportunities that are in front of them.

Second, and I think even equally more important than that, is we need to understand, within the Federal agency, I know there was some talk about interacting and working together. I know we are talking about energy today, but there was a water structure that was done and Bureau of Reclamation took the lead on it, but they worked with Indian Health Service (IHS), they worked with the U.S. Department of Agriculture (USDA), they worked with four different other components, State agencies as well, to deliver water to a chapter within Navajo Nation.

Each of them had a different component that they could fund. They could not fund the whole project entirely. Each took different components of it. As they worked together you saw a synergy take place, and the project was able to get completed. Very rarely do I ever see synergy take place between multiple agencies working together, whether it is the Federal Government, State government, or even with the Tribal communities themselves. I think that is a huge component of this. We need to raise the capacity but more importantly than that, those assets are out there—how can we communicate and work efficiently together?

In closing, I want to tell you this. I know I only have 2 minutes and I will deviate. Sorry, Senator Sinema, but I am just talking now, so I hope it is OK.

I had a dean at Northern Arizona University (NAU). His name was Craig Van Slyke. His first day he came in I met with him, and he was from St. Louis, and he was eager to engage. About a week later I had the Hopi Tribe. We were talking, we were developing, and I asked Dean Van Slyke to actually come in and do a welcoming. He said he was busy and he could not so he sent an associate dean. The associate dean came in and said, "Hey, it is great to have you here, Hopi. Any questions, follow with Levi," and he walked out the door.

After about 5 hours we were concluding our discussion. The dean popped his head in and saw us and got really excited. He said, "All right." He jumped in, did introductions, talked for 30 or 40 minutes, and then he left.

I had a good friend from Hopi invited me to their dances. His name was Cliff. I said, "Hey, I cannot make it to it but what about the dean." "Do you think he would go?" I said, "Let's go ask the dean." I asked him and he said, "Oh, that is a great honor."

Two or 3 days later, Cliff came back to Northern Arizona University. He drew a map and said, "This is where my sister's house is, and she will be expecting you." He went over some of the dos and do nots. Do not take your camera. Know where you need to be. Do not look at certain things.

About 2 weeks later I was engaging with Dean Van Slyke and I said, "How did it go?" He looked perplexed to me. And I said, "Uh oh. Something must have happened." He said, "Levi, I want you to

know, I took this job to help students be successful. I don't know nothing about the Hopi Tribe. I don't know anything about the other Tribes here in Arizona. How can I help them be successful if I do not know who they are?"

I define success not making an A in a class or graduating from college. I define success as reaching your true potential. I know you have a consultation policy with Department of the Interior (DOI) and others. That is a key component to really helping Tribes reach their true potential and their success, and I think resilience is a natural with the Tribes because we have been resilient since time immemorial.

With that I say thank you, and to-pik [phonetic].

Senator SINEMA. Thank you, Mr. Esquerra.

Ranking Member Lankford, would you like to introduce our fourth and fifth witnesses?

Senator LANKFORD. I would be glad to.

Senator SINEMA. Good.

Senator LANKFORD. Sorry for the long hesitation. A little technical jump there as well again.

Is Mr. Nickell and then Mr. Bryce the order you would like to go, Madam Chair?

Senator SINEMA. Great.

Senator LANKFORD. Let me introduce Lanny Nickell. He is the Executive Vice President and Chief Operating Officer (COO) of the Southwest Power Pool (SPP), which is actually the power area that covers my home State, in Oklahoma. He is responsible for the provision of engineering, operations, information technology (IT) services to members and customers.

He began his career in planning and engineering for the Public Service Company of Oklahoma. He joined Southwest Power Pool in 1997 as an operations engineer, where he helped establish Southwest Power Pool's reliability coordination and tariff administration functions. He was promoted to the management team in 1998, and became Vice President of Operations in 2008, Vice President of Engineering in 2011, Senior Vice President of Engineering in 2019.

I cannot imagine a more fun job than to be in leadership of Southwest Power Pool, last February, when we were dealing with very difficult times.

We are grateful that you are here to be able to walk through this. We look forward to your testimony.

**TESTIMONY OF LANNY NICKELL,<sup>1</sup> EXECUTIVE VICE PRESIDENT AND CHIEF OPERATING OFFICER, SOUTHWEST POWER POOL**

Mr. NICKELL. Thank you very much for that introduction, Ranking Member Lankford, and thank you to Chair Sinema as well as Ranking Member Lankford and Members of the Subcommittee for the opportunity to participate in this very important hearing.

As Ranking Member Lankford mentioned, I am the Chief Operating Officer of Southwest Power Pool. Southwest Power Pool is responsible for assuring affordable and reliable delivery of wholesale

<sup>1</sup> The prepared statement of Mr. Nickell appears in the Appendix on page 63.

electric power across our 14-State region in the central part of the United States.

SPP relies on a diverse portfolio of generating resources, a well-functioning wholesale energy market operated across a broad, multistate footprint, and a robust electric transmission system to reliably deliver electricity to our utilities at the lowest possible cost. We very much understand and appreciate the critical role energy infrastructure plays in assuring our nation's safety, security, and vibrant economy.

I can also assure you, we understand it even better after our experience with this year's winter storm Uri. Winter storm Uri was severe, particularly in our part of the country where many locations experienced record-low temperatures. The extreme cold caused record amounts of wintertime electricity consumption in our region.

That consumption would have been even higher, and would have exceeded our previous winter record by more than 8 percent on Tuesday, February 16th, if we had been able to access sufficient energy supply. Unfortunately, only 42 percent of our generating capacity was available this time, which was 37 percent lower than what we expect to have during peak consumption periods.

While nearly all types of generation struggled to perform at expected capabilities, gas generation was most impacted, with 57 percent of its expected capacity being unavailable. Nearly half of this unavailability was attributed to lack of fuel.

Despite our best efforts, and as a last resort, we were required to interrupt electric service twice, for a total of nearly 4 hours across 2 days, with the maximum amount of service interrupted representing 6.5 percent of our regional energy demand at the time.

We very much appreciated and benefited from the tremendous amount of energy we received during this time from neighboring regions. This was enabled by our strong relationships and even stronger electric transmission interconnections. At times, nearly 14 percent of SPP's consumption was supplied from external parties through those interconnections.

To put that in perspective, Eastern, Western and the Electric Reliability Council of Texas (ERCOT) total interconnection capacity would have allowed no more than 1.5 percent of its energy needs to be supplied externally during this event. We would have had to interrupt much more service for longer periods of time without the assistance that we received from our neighbors.

I believe there are three key opportunities to improve energy infrastructure that will best mitigate the potentially disastrous results of these extreme events. First, we need to better assure access to an adequate amount of generating facilities that we can count on when they are most needed. At a minimum, we must know more accurately what we can count on in order to be better informed of the reliability value provided by those resources.

Second, additional investments in the gas industry are needed to more reliably produce and deliver fuel to generators during these conditions. It is also imperative that decisionmakers better understand the relationship between the gas and electric industries and how those industries impact each other.

Third, a strong electric transmission grid provides significant value during these types of events because it enables access to a much larger portfolio of generation and provides increased resilience. SPP realized this value first-hand. To better inform transmission investment decisions we must include extreme scenarios in our planning assessments and better recognize the value of increased resilience.

In conclusion, I know the cost of increased energy infrastructure needed to adequately ensure our nation's future can be expensive, but not having this form of adequate insurance when catastrophe strikes is likely to be much more costly.

Thanks again for the opportunity. I stand ready to answer any questions you may have.

Senator LANKFORD. Mr. Nickell, thank you very much for that. I appreciate your testimony today.

Let me next introduce our last witness and that is Robert Bryce. Robert Bryce is an author, journalist, film producer, and podcaster. He has been writing about energy, power, innovation, and politics for more than three decades. He is the acclaimed author of six books, including most recently *A Question of Power: Electricity and the Wealth of Nations*. He also is the host of the *Power Hungry Podcast*.

Mr. Bryce, we are ready to receive your testimony.

**TESTIMONY OF ROBERT BRYCE,<sup>1</sup> AUTHOR, JOURNALIST, AND PUBLIC SPEAKER**

Mr. BRYCE. Many thanks. Good afternoon to you and thank you for the opportunity to testify today. Senator Lankford, I am a native Oklahoman so it is a pleasure to speak in front of this Committee. In fact, I have been in Oklahoma looking at energy infrastructure here over the last few days, and over the last 5 years have been all over the world, in fact, looking at the world through the lens of electricity, including a new documentary that I produced called *Juice: How Electricity Explains the World*.

My point today is to focus on the electric grid. America's electric grid is our most critical piece of energy infrastructure. The grid is the mother network, the network upon which all of our critical systems depend. But the affordability, reliability, and resilience of our electric grid are being undermined. Over the past few years, the fragility of our grid and its vulnerability to cyberattacks, physical attacks, and extreme weather events has become ever more obvious.

I understand this vulnerability firsthand. In February, my wife, Lorin, and I were blacked in central Austin for 45 hours during Winter Storm Uri. Between 2000 and 2020, the number of what the DOE calls "major electric disturbances and unusual occurrences" on our grid jumped nearly 13-fold. Sales of standby generators, made by companies like Generac, Kohler, Caterpillar, and others are soaring.

Our grid is being fragilized by three things. First is the increasing reliance on weather-dependent and intermittent renewables like wind and solar. In August, the North American Electric Reli-

<sup>1</sup> The prepared statement of Mr. Bryce appears in the Appendix on page 78.

ability Corporation identified changing resource mix as the most urgent challenge facing the electric grid. It also said our generation capacity is, I quote, “increasingly characterized as one that is sensitive to extreme, widespread, and long duration temperatures as well as wind and solar droughts.” A prolonged wind drought is one of the reasons why Britain and much of Europe is in an energy crisis today.

In March, at a Senate Environment and Public Works Committee hearing, Xcel Energy CEO Been Fowke said, I am quoting, “At higher levels of intermittent renewables the cost of the energy system begins to skyrocket and its reliability degrades.”

The second factor, dozens of coal-fired power plants as well as several nuclear plants, which provide resilient baseload power and help keep the grid stable, have been prematurely shuttered. The closure of those plants has made the grid more reliant on just-in-time delivery of natural gas. I am pro natural gas, but since Enron declared bankruptcy 20 years ago, the amount of gas burned for power generation has more than doubled.

Finally, regional transmission organizations like ERCOT in Texas and California Independent System Operator (CAISO) in California are not providing enough incentives to assure the reliability and resilience of the electric grid.

So what must be done? First, Congress must prevent the closure—should do all it can to prevent the closure of more coal and nuclear plants until regulators can be certain that their closures will not reduce the reliability and resilience of the grid.

Second, the Federal tax incentives for wind and solar energy, the production tax credits (PTC) and the investment tax credits (ITC), which are costing taxpayers billions of dollars per year, must be eliminated. These subsidies distort wholesale power markets, make the grid more reliant on the weather, and undermine the financial viability of the thermal power plants that are essential for grid reliability. For years, renewable energy advocates have claimed wind and solar are the cheapest option. It is high time for them to prove it.

Third, Congress, along with Federal regulators, should develop rules that incentivize onsite fuel storage at power plants. The blackouts in Texas that I lived through showed that the most reliable power plants during the blizzard were the ones that had onsite fuel, including the coal and nuclear plants. Federal incentives do not have to be limited, though, to coal and nuclear. They can also include fuel oil, which can be used in quick-start combustion turbines or in large reciprocating engines.

Power plants with onsite fuel are absolutely essential for system resilience. If a regional grid fails, the grid operator must perform a black start, to re-energize the grid. Those black start generation units must have onsite fuel, and in the postmortem of the ERCOT blackouts it was clear that those black start units were not ready, and many of them did not have enough fuel.

Fourth, Congress must act to stop the closure of existing nuclear plants, including the scheduled closure of the Diablo Canyon plant in California beginning in 2024. The closure of our existing fleet, including the April closure of the Indian Point nuclear plant in New York, was a travesty. Congress must also work to accelerate

the licensing and deployment of small, modular reactors, which will bolster resilience and help with decarbonization.

In conclusion, for too long policymakers have ignored the fragility of our electric grid. The grid is our biggest, most complex, and most important piece of energy infrastructure. We take it for granted at our extreme peril. We cannot allow our electric grid to fail.

Earlier this year, the writer, Emmett Penney, had it right when he said, "There is no such thing as a wealthy society with a weak electric grid." We cannot afford to have a weak electric grid.

Thank you very much.

Senator SINEMA. Thank you so much, Mr. Bryce. Now we will begin the question portion of the hearing. Each Member of the Committee will have 7 minutes, and I recognize myself for those first 7 minutes.

Mr. Herrgott, as you heard in Mr. Esquerro's testimony, Arizona Tribes have faced hurdles they could not overcome when attempting to enter into power purchase agreements to develop renewable energy and improve economic opportunity. What steps can we take with permitting and related issues to make sure that Tribes have ample opportunity to engage in energy production activities?

Mr. HERRGOTT. Thank you for that question. I think it is important to realize that Tribal sovereignty also means Tribal energy independence, and the current structure and the way in which the Bureau of Indian Affairs (BIA) and other Federal gatekeepers regulate and give permission to Tribes, whether they be a direct service Tribe or a more independent, larger Tribe like the Navajo or the Hopi or the Ute Tribe in Utah, oftentimes makes it more difficult for them to be able to harness the opportunities for new investment.

As my good friend, Levi, pointed out—who I have spent a good amount of time within Arizona—it is the institutional capacities on how to actually formulate a purchase power agreement. How are you not perceived to be steamrolled by developers that are moving through Tribal areas?

It is important that we recognize that giving Tribal sovereign nations the ability to develop their own energy is something we should have been doing months ago, not waiting 6 months for BIA to give that Tribe permission.

Senator SINEMA. Thank you. Mr. Esquerro, while developing the Federal Permitting Reform and Jobs Act with Senator Portman I wanted to make sure that we were deliberate in our efforts to protect Tribal interests. We accomplished this in two ways. First, we required that the Permitting Council produce annual best practices for effective coordination with tribal stakeholders. Second, we made sure that information provided by Tribes would remain confidential and would not be subject to FOIA to preserve sacred, cultural, and historic sites.

In your testimony, you noted that engaging with Native Tribes, from patience comes respect, and after you have respect, trust will surely follow. For too long, Native Tribes in Arizona and across the country have not been treated as partners. So what impact will the Permitting Council reforms have on building respect and trust, and what additional steps should the Federal Government take on this front?



Mr. ESQUERRA. I am sorry about that. Thank you, Senator. As I said in my testimony, just having Tribes to have the same competitive access to funds as a State I think is a great step in the right direction. I think the other thing that is really key that needs to be done is, as you take time to listen and learn from the Tribes, and whatever is in your capacity you can go back. A lot of times Tribes, we are talking about electrified renewable energy project—I bet you every Tribe here in the State has plans, but it has always been the failed implementation of how to get that done, and I think that is what your question goes to.

I think the one thing is, is building that capacity. The other thing is working with the Bureau of Indian Affairs to increase their capacity as well, especially if you are talking about leasing lands. They have to do fair market value for the lease, and how do you determine fair market value, or future market values, when it comes to place?

But I am just thrilled by just the changes that you have made, that you are proposing in this legislation, because that truly opens up the door for Tribes to have the same opportunities that States have, but more importantly, I think that goes to building that relationship of trust. A lot of Tribes feel like there has been mistrust, throughout our history with the United States. This is the direction that takes you in a different—because you are actually saying, “Hey, you have the same opportunity as States, and we are going to treat you as the same.” Thank you.

Senator SINEMA. Thank you.

Mr. Yonker, it is clear from your testimony and from the data available that the threats causing grid disruptions are becoming more frequent and their effects are more severe. We have seen this in Arizona with the effects of both wildfire and extreme heat.

Can you provide examples of actions that States, the Federal Government, or energy providers have taken to address these threats?

Mr. YONKER. Absolutely. Thanks for the question. First I would start with the basics, ensure that there is robust vegetation management, critical infrastructure is being refreshed and maintained, and basic monitoring is in place. Second, you start with comprehensive planning in place that is beyond just grid. It gets into other critical infrastructure—public safety, health, and others. Then third, you have to get into the actual deployments, and you can precisely target them—real-time sensing, grid analytics, and other capabilities.

But let me give a couple of examples. In Washington State, Governor Inslee has created a clean energy fund that helps provide tens of millions of dollars to annually support grid operators in deploying advanced capabilities, and in their last legislative cycle they set aside \$125 million specifically for forest restoration and community resiliency.

Another quick example. The Bonneville Power Administration (BPA), a Federal agency, has developed an annual wildfire assessment plan, and this year they had to put it in action when there were wildfires raging in southern Oregon, and it helped them continue to keep operations of their transmission infrastructure going.

Third, and very quickly, the National Labs in California are testing a very novel concept that would de-energize a line in under a second before it hits the ground. So think about the real-time analysis that is needed to do that, and this is at the core of a lot of the Federal investments that are being made.

Senator SINEMA. Thank you. I understand that Senator—actually, I think I have time for one more quick question, so I am going to go quickly to Mr. Yonker. In your testimony—again, a follow-up question for you—you laid out four keys to improving and maintaining grid resilience—flexibility, reliability, affordability. I am interested in exploring one of these in more detail—demand response. This is about keeping customer demand and electricity supply in balance.

Arizona Public Services is a leader in implementing this system, and that is important as our energy mix and grid technologies continue to evolve. Can you tell us what role demand response plays in managing peak energy demand and reducing strain on the grid, and how does it complement renewable and peaking generation assets?

Mr. YONKER. Great question. So demand-side management is leveraging the flexibility that customers have to bring value on the overall grid system, and customers benefit. They get incentives. They get to be a part of the solution, and it also helps them keep their rates low.

A commonly used form of demand response, for example, could be leveraging smart thermostats. So in this way, an aggregator or grid operator is going to send a signal to a smart thermostat and the customers are going to respond.

But let me give you a couple other examples. There is nearly 200 gigawatts of flexibility from both traditional and more tech-enabled demand response that could reduce peak load by 20 percent, it is estimated, and save over \$16 billion annually. There is a company in California called OhmConnect. They are working toward building out 550 megawatts of the virtual power plant that they say could cut half of what was needed for the 2020 blackouts. They have 150 megawatts now.

My utility here in Oregon is leveraging a portfolio of demand-side distributed assets. This, in many ways as I said in my testimony, is what helped them mitigate the impacts of the outages from that 115-degree day.

But what I would like to emphasize is that they just filed a plan, for 2030, where they think they can get 25 percent of their power needed for the hottest and coldest days from that demand flexibility and from aggregating distributed energy resources (DER). So it can be a very central role in running a modern grid.

Senator SINEMA. Thank you. My time has expired. I understand Senator Lankford wants to defer his questions to the end. So with that I will turn to Senator Carper for his 7 minutes. Senator Carper, you are recognized.

#### **OPENING STATEMENT OF SENATOR CARPER**

Senator CARPER. Thank you, Madam Chair, and I want to thank the Ranking Member for deferring his questions to the end. That is very kind, James. Thank you.

To our five witnesses, welcome one and all. I look forward to the time we actually do this together, and we can thank you in person.

I want to start my first question, if I could, with respect to electricity grid resilience, with you, Mr. Yonker. Do you feel up to it? All right. Good.

As we all know, climate change is affecting just about every aspect of the electric grid in all parts of our country, from generation, including transmission, distribution, to also include demand for electricity. The electricity sector currently accounts, I am told, for about 27 percent of total U.S. greenhouse gas emissions, about another 25 percent is from power plants and another 23 percent coming from industrial operations. Think of cement plants, for example.

As we saw with the Texas power grid failure, people too often try to blame renewables for not performing during an extreme weather event. But the real truth is that all energy sources, and that includes natural gas, includes coal, and wind, are vulnerable if not properly weatherized or made resilient for catastrophic climate events.

My question, Mr. Yonker, would be this. Do you agree that wind turbines and other sources of renewable energy can generate the power in cold weather without problems if proper resiliency measures are taken, and clean energy does not necessarily mean unreliable energy? Do you want to take a shot at that?

Mr. YONKER. I agree that clean energy does not necessarily mean unreliable energy. I think, like I said in my advance forecasting remarks, computational power is letting us have a new wave of capabilities to forecast and almost dispatch these variable resources. When you pair them with additional assets, like a battery that gives you multiple hours of flexibility, it becomes, in many ways, with expectations for, short-term forecasts, a much higher-capacity resource. But I agree with that.

Senator CARPER. All right. Good. Just a follow-up question. Do you agree that if resiliency measures that adequately account for the impact to climate change are not taken, every source of energy can be vulnerable to extreme weather events, like the crisis we saw and we have just been talking about here in Texas earlier this year?

Mr. YONKER. Texas was not the failure of a single generation supply. It was a failure of advanced planning for an extreme event, and so it had cascading failures. So yes, I agree.

Senator CARPER. All right. Thank you. One more question for you and then I will pick on the other members of our panel. With respect to modernizing the electric grid, critical energy infrastructure includes both physical and cyber infrastructure. It includes pipelines. It includes energy generationsites as well as technology systems and software that help keep our energy systems up and running.

The Infrastructure Investment and Jobs Act, which the Senate passed by 69–30 bipartisan vote on August 10th—a happy day in my life, and I think in most of our lives—but anyway, that bipartisan vote on August 10th includes funding to help improve the resiliency of our nation’s critical infrastructure. Specifically, I think in the legislation there is more than \$47 billion in new funding for

critical infrastructure resiliency programs, including cybersecurity efforts, including weatherization, wildfires, flood mitigation, and additional funding also for grid modernization, all in that bill which a couple of my colleagues, especially Senator Sinema, had a lot to do with the crafting.

The question I have, in addition to making electric grid investments, which we know have been inadequately funded, what can we do, as lawmakers, to further support advanced grid modernization activity?

Mr. YONKER. I know you want me to be quick so I will not recap with everything that you mentioned that is in the package. Hopefully we can talk more about it. We are very supportive of it.

I am going to mention the title, of eight things we think there could be additional support for that we know is not quite as supported in the bipartisan packages we saw.

Grid modernization and flexibility. It is in there some. It is a huge issue. There needs to be more of it.

Let's appropriate the Energy Act of 2020. The RD&D in that is critical, and only very small bits and pieces of it have been fully appropriated.

As you mentioned, cyber. Cyber was only \$600 million. That is not enough for what we need to do to keep the frontier of our cyber capabilities leading class.

Demand side management, as we talked about with Chair Sinema, was not funded. That is a key building block. We need to get some support behind that.

Wildfire mitigation and grid resiliency we are somewhat focused on. Let's do more.

Workforce development, we did not see for advanced grid capabilities. Let's get more innovations, long duration storage, microgrids, DER optimization, and then last, energy transition for local support.

Senator CARPER. Thank you. Thank you for all of those. That was great. You covered a lot in a very short period of time. You could do this for a living.

My next question is for Mr. Herrgott?

Mr. HERRGOTT. Yes, Senator.

Senator CARPER. OK. Thank you. Has your name ever been mispronounced?

Mr. HERRGOTT. The last hearing I was in front of you I think I pronounced it incorrectly in front of you.

Senator CARPER. I recall that. Good to see you again. In your testimony you mentioned the challenge of staffing and funding shortfalls at permitting agencies which contributes to project delay. The last time that the Council on Environmental Quality (CEQ) assessed agency capacity for environmental reviews it found that more resources were needed at these agencies in order to improve review times.

My question would be, would you agree that it makes sense to increase agency capacity to improve efficiency and address this longstanding problem? That would be the first half of my question. The second half, would you support greater Federal funding to permitting agencies, for example, like the Bureau of Land Manage-

ment, in order to complete environmental reviews and public participation? So it is a two-part question, if you would.

Mr. HERRGOTT. Sure. Thank you. I think the first unfortunate reality is the younger generation is graduating from college with biology and engineering degrees and are rushed to go work for the BLM, the Forest Service, or become a biologist at the U.S. Fish and Wildlife Service (FWS), which is why we have 100 vacancies currently at BLM for project managers. So you have one regulator that has a \$2 billion project and must review a 1,000-page application, and that slows down the process.

So yes, funding is an issue but it is also the reality that we have to right-size the way in which we move applications through the Federal Government, because it is a black box and sometimes we forget there is a 29-year-old biologist that must review a \$4 billion transmission line, and then we complain when there are delays. So that is the important part.

I also think we have to be very careful about deemed approved and hard deadlines on private approvals, because what is occurring is frontloading the process, and it is OK informal process on the front end which puts a lot of stress on individuals at the Forest Service, the Department of Interior to deem an application, but before the clock starts FPISC and one Federal decision and all these accountability tools get to work and there is no real guidance or education or training, both on the project developer side and the disconnect between the regulators when they do not talk. The fact the projects actually work is an exception, not the rule.

So short answer, yes.

Senator CARPER. All right. I like that short answer. Thank you very much. Good to see you again. Thanks for your help. Madam Chair, thanks so much.

Senator SINEMA. Thanks so much, Senator Carper. I believe Senator Portman is still voting so we will move to Senator Padilla next. Senator Padilla, you are recognized for 7 minutes.

#### **OPENING STATEMENT OF SENATOR PADILLA**

Senator PADILLA. Thank you, Madam Chair. A couple of questions that are in some ways follow-ups to items that have been raised earlier. But to set the stage, last year the Department of Energy found weather-related power outages have increased by 67 percent since the year 2000. Across the country, extreme weather events are increasing in both severity and frequency—I think we all recognize that—and that has significantly strained electrical grids, whether it is extreme heat, extreme cold, and everything in between. Now these events erode public confidence in the grid and leave vulnerable populations in the dark for days, literally.

Like many States, California continues to see an increasing in extreme weather events that have prompted outages and power shutoffs. That is why I was proud to partner with Senator Cornyn to introduce our Power On Act in the Infrastructure Investment and Jobs Act that passed the Senate in August. While this bill is just a start, it provides critical funding for utilities and States to upgrade and modernize their grid infrastructure to better withstand extreme weather and increase the overall reliability of the grid.

Mr. Yonker, as you noted, the Infrastructure Investment and Jobs Act is going to be important for the resources it provides for grid stability and resiliency. Can you just expand on that by sharing maybe what some of the risks are and potential future impacts if we do not begin to evaluate the strength and reliability of our grid through the lens of resiliency, not just reliability but resiliency?

Mr. YONKER. Yes. I think the start of the package section, 40101, for those who know the details, to get into resiliency, those billions of dollars could not be more needed from utility States and other locations, especially some of the funding that is focused for smaller communities and more rural communities.

To answer your question on what will happen if we do not fund this adequately, we can expect higher outages. There was a Washington Post article that described doubled outage time in the last 5 years. This could continue if we do not invest in our grid and have it be resilient.

Certainly lost productivity. The Chair mentioned the nearly \$9,000-a-minute impact for data centers. I saw in that article that it also cost large manufacturers \$1 million an hour and large retailers \$5 million a day. As we have been talking about, the loss of life. This last 9 months has been hugely impactful. Hundreds, if not thousands of people have been directly impacted from the severe weather events.

So heat impacts, fire impacts, wind, water, ice, these are things that are going to be stressing our grid. We need to be proactive in investing in them.

Senator PADILLA. One more minute on the cybersecurity concerns that you raised earlier, is part of the same package?

Mr. YONKER. Absolutely, so the subtitle on cybersecurity is fantastic. From what we have seen, we have not noticed cyber funded for about a decade, from package energy legislation. Is \$600 million enough? I would argue no.

Cyber considerations have to be in anything. We saw a study from Siemens a year and a half ago that said 56 percent of energy operators have experienced a data breach. I am just going to quote really quickly from the Government Accountability Office (GAO) Electric Grid Cybersecurity Report. I quote, they recommend that DOE develop a plan that addresses the key characteristics of a national grid strategy, including a full assessment of cybersecurity risks. DOE agreed to that and they are working on it. It has to be central to the investments that we make on our system.

Senator PADILLA. I could not agree more. Thank you for your testimony.

One more question, this one for Mr. Herrgott. As noted by you and others, many of the renewable energy projects needed to meet our greenhouse gas emission targets remain in various stages of planning and development. So as we work to combat the climate crisis and transition to a green economy we must also work together to ensure that the permitting processing for clean, renewable energy projects is streamlined while also maintaining important environmental protections.

Can you discuss the importance of making the Federal Permitting Improvements Steering Council permanent, and how the coun-

cil could help meet the streamlining of permitting and climate goals?

Mr. HERRGOTT. Sure. Thank you for the question. I think, at the outset, it is important to point out that more than 99 percent of all new wind, solar, energy storage, and carbon capture are entirely supported by the private sector, unlike roads and bridges. They are not going to move forward and invest capital that will start a 2- to 3-year planning and pre-engineering phase before they get to the 2- to 6-year for transmission lines environmental phase, and then the 2 years, especially with cash-strapped supply chains, 2 years to acquire all the materials, then 2 years to build, which is how they get to 10 years. Look, they have the long-term reliability because we have already had two or three transmission lines in the last year where utilities and companies just walked away.

The Federal Permitting Council, making that permanent, gives the long-term certainty to U.S. companies, foreign as well, to invest in these multi-billion-dollar projects. Although we are looking at microgrid and new technologies, that is to retrofit an energy grid that is about 80 percent less than what it should be now.

We should be pulling in new technologies by incentivizing, with predictability, through a process where we can start to dial down on the time it takes to advance renewable energy, because they are missing out on franchise agreements and the ability to actually provide a reliable source of new energy to offtakers in towns and cities across the country.

Senator PADILLA. Thank you very much. Thank you, Madam Chair.

Senator SINEMA. Thank you, Senator Padilla. I think Senator Portman may not be back yet from voting, so Senator Lankford, I will turn it to you to start your first round of questioning.

Senator LANKFORD. Great. Thank you, Chair. Let me go through quite a few questions, because I am going to kind of drill down on several issues that are here. Mr. Nickell, I want to begin with you. Obviously, the issue of diversity of fuel sources has come up several times, trying to figure out how do we make sure that we have a diversity of fuel sources, so if we have problem with one we have availability in others.

We have had a lot of conversation around wind and solar. Obviously making those more resilient has been an issue. We can make those more resilient but they are always going to be intermittent. There will be long periods of time, especially in the central part of the United States, where we will have days without a lot of sun and we will have days that we will have less wind, as they are experiencing right now across Europe and UK, causing some of those issues.

So let's talk a little bit about diversity of fuel sources. What do we need—how do we know when we have overproduced or we are over-reliant on some sources that are more intermittent?

Mr. NICKELL. Thank you, Ranking Member Lankford, for that question. It is an important question, and I think the observation is very real and accurate. Diversity of resources is very helpful. None of us would invest in a single stock and plan on that stock to be our retirement plan. I think the same thing can be said of

generating resources. The more diversity we have, the more we can count on being able to deal with any number of different events.

This winter we were able to count on all of our diverse resources—gas, coal, wind, hydro, nuclear. It all produced. To some extent, a lot of it produced at a much lower degree than what we had hoped and expected, based on our studies. That is the real issue.

The real issue is not whether we need less diversity or more diversity. What we need is to be able to better understand how that diverse portfolio of resources is expected to operate during these varying conditions, whether it be wintertime conditions, summertime conditions, fall, or spring. That is our job, and that is what we need to do a better job of going forward, is better understanding what to expect from that diverse portfolio of resources.

Senator LANKFORD. I want to drill down on a couple of things on that. One is you had mentioned before interconnectivity, obviously, with other regional transmission groups. So you stated for Southwest Power Pool there was enough interconnectivity there. I have two sets of questions. Is that true for the other Regional Transmission Organizations (RTOs), they have enough interconnectivity? We obviously had 4 hours, as you mentioned, that was down time, so it was clear we were not able to take in enough during those times periods, or the other RTOs were not able to be notified fast enough to be able to get it over. Obviously, Texas has a different issue there with it.

So the two sides of this. One is where does that strengthen us to have more connections, and do we have enough connections, and the second part is what does that make us more vulnerable, to have more connections with other RTOs?

Mr. NICKELL. As I stated in my testimony, we were very blessed and we realized a lot of value by the virtue of having the interconnected capability we did with our neighbors.

Now SPP is a region that operates in what is referred to as the eastern interconnection. Another interconnection is the western interconnection. That is where Madam Chair receives her energy from, the utilities that operate in the western interconnection. Then you have the majority of Texas that operates in an interconnection known as ERCOT. By virtue of being in the eastern interconnection, and by virtue of having tremendous interconnection capability with our neighbors, we were able to have access to hundreds of thousands of megawatts of generation, to the extent it was available and to the extent the transmission system was able to deliver it.

Because you have interconnection capability does not mean you have transfer capacity, and that is what really helped, is that we had enough transfer capacity to be able to import, at times, 6,000 megawatts. If that had been continuous throughout the entire 7-day week, we would not have had to shed load. Unfortunately, there were a few times where the transmission system, on an intervening system, was just simply not able to deliver that power to us, at the 6,000-megawatt area or level that we had been able to rely upon for most of the event.

So without that capacity we would have seen a lot worse of a situation. We would have had to shed a lot more load. It could have



looked more like what ERCOT experienced if we had not had the benefit of interconnection capacity.

Now, could we use more of it? Absolutely. But that has to be determined and assessed on a cost-benefit basis. One of the things that we have to do a better job of, when we value the investment decisions that are being made and we are determining the benefits of those, we have to do a better job of understanding the value of resiliency and the increased resiliency that is available and afforded to us by transmission expansion.

Senator LANKFORD. I know this is going to be evaluated based on costs, and in my second round of questions I am going to have lots of questions for some of the other folks that are here on the panel, so I appreciate your insight as well.

Mr. Nickell, I want to drill down on one other thing. There has been a lot of conversation about the natural gas side of things. When I talk to the natural gas folks they will say they were electricity power-dependent, that once they lost power, and they have rolled off, for whatever reason for them, the well heads froze, they were not able to produce, then they were not able to send natural gas to do more electricity generation, which made the problem even worse and it became this event. When they lost power, then they lost capacity, and it became a bigger issue.

One of the issues there is identifying those locations where, if you have to be able to pull some spots offline—hospitals, for instance, nursing homes—also that your well heads and your places that are actually sending natural gas to your generation would also be on that list. Is that in conversation right now? Where does that stand?

Mr. NICKELL. Senator, it is in conversation right now, and we are really embarking on that learning exercise right now. One of the things that I think has to happen, we have to do a better job of, and that is we have to communicate more. The gas industry, the electric industry has to get together at the table and talk, and we have not done a good job of that in the past. That is why you are hearing, and other people have heard, similar comments and similar explanations for why gas did not perform.

I know, anecdotally, based on some of the things I have heard, that there is some evidence that that occurred. It is certainly not the whole story, and it is certainly not the primary cause of the gas failure in SPP.

Nevertheless, the more we can talk, the more we can communicate about how to work together more effectively, the better chance we have of resolving the issue, the right issue, and answering the right question with the right solutions.

Senator LANKFORD. What would you say is the primary cause on the gas failure there for SPP?

Mr. NICKELL. In SPP, what we know is that there was a lack of fuel supply, and we believe, based on information that our market monitor has produced, is that it was a combination of two things: gas just simply was not available and/or gas prices were too high. Those were the two leading drivers of the gas unavailability.

Again, having said that, I also know that there are situations, and were situations, where gas was not available because its electric service was shut off. I mean, we do know that that happened.

We just do not think that that was the largest contributor to their lack of availability.

Senator LANKFORD. Chair Sinema, could I just ask one more question here, just to close the loop on this?

Senator SINEMA. Sure. Of course.

Senator LANKFORD. The issue on the gas side is a really important issue in trying to be able to determine dependency on where this goes. Right now I do not know what the standards are for any of those that are producing electricity, on what amount of gas that they are going to do by contract in advance, what they are going to purchase on spot price, and what they are going to do in storage that they have for quick capability on that.

What is the typical formula? Now I know in SPP it is going to be different State to State on how that is handled, but the issue of how much gas is available on contract, what the price is going to be on the spot—obviously that floats from day to day—and what they have actually got onsite will matter in how much they are able to use in those peak moments. What is the basic formula for those three?

Mr. NICKELL. I wish I could give you a better answer than what I am about to give you, so let me just apologize in advance. SPP does not have any rules or criteria around how much of that gas should be purchased on a firm basis or on a non-firm basis, as you refer to, on the spot. What we do expect is that if a gas-fired generator is going to be counted as a credited capacity that it does need to have firm fuel supply during the period of time that it wishes to be accredited.

It is kind of, if you want to be considered valuable you must do this. But it is really a choice that the generating utilities make regarding how they pursue that question.

Senator LANKFORD. The challenge becomes then, if you get into a crisis moment where everyone is trying to get more natural gas, the spot price dramatically increases, and we will come back and talk about that later. That becomes a pretty big issue if you do not have enough storage that is available to you and you are fighting with everyone else to be able to get access to other things. You do have a critical gap that is there, on very cold or very hot days. What is your reliable power? That is not intermittent at that point. If your intermittent goes down your reliable power is now not reliable, just based on access to the source. Am I tracking that correctly?

Mr. NICKELL. Yes, absolutely, and you become much more exposed to really high gas prices, which is exactly what we saw in February and what drove a lot of our energy prices in our market to record high levels.

Senator LANKFORD. This seems like a solvable issue in trying to be able to establish how much we are going to have to do on contract, to have a firm commitment there to be able to come in, because natural gas is not something you can just turn on more of at an instant and try to figure out how to be able to get more out. Then if you have the snowball effect with everyone else going after it, especially when Texas was hit desperately at that point and so many people that were selling were selling south at that point, it becomes a much bigger issue.

Chair Sinema, thank you very much for the extra time there.

Senator SINEMA. Absolutely. Thank you, Senator Lankford. I recognize Senator Portman for his 7 minutes of questions.

Senator PORTMAN. Great. Thank you, Madam Chair, and thank you guys for great testimony today. In my opening statement I talked about the Permitting Council, and I want to get back to that in a minute. But first I was interested in some of the things you said. Mr. Yonker, you talked a little bit about flexibility and adaptability of both the supply and demand as being important to a resilient 21st Century grid.

As you know, perhaps, the bipartisan infrastructure bill does include a number of provisions for energy efficiency, including some provisions from the work I have done with Senator Shaheen over the years on helping on efficiency, also weatherization for low-income Americans. What role does energy efficiency play in tempering the demand side of this, in terms of being sure we have a reliable grid and helping to supports its overall operation and reliability?

Mr. YONKER. We do not weigh a whole lot into generation mix topics, but this is an exception to that rule. Absolutely, cost-effective, energy-efficiency resources, deployed first they lower the bar. If we have a peak need or we have a grid disturbance it just makes it easier to deal with that. So efficiency being deployed at scale is a great place to start, is the place to start.

There is some really interesting overlap between automated energy efficiency and demand-side management and DER integration that is really blurring those lines in smart buildings and other areas that, as you said, is importantly supported in the package.

Senator PORTMAN. Great. I appreciate that and I do think it is an important part of the answer, and it is bipartisan, and it is something that is so great for the economy. It makes us more competitive globally to have more efficiency, because there are lower costs and manufacturing is an example. I appreciate your focus on that.

Mr. Bryce, in your testimony you state that policies to ban the use of natural gas and to, as you say, electrify everything are dangerous to the reliability of our electrical grid. You talk about concerns about not having enough energy resources and diverse energy resources.

This is exactly what is going on in Ohio. In Ohio, we have a very diverse portfolio but coal and natural gas still provide more than 80 percent of our State's electricity, and increasingly it is natural gas, about 40 percent coal, it is about 45 percent now and nuclear is about 13 percent and renewables are about 2.5 percent.

Can you, Mr. Bryce, talk a little about the benefits of a diverse energy portfolio and how energy innovation in renewables, in storage technology, in advanced nuclear and hydrogen, and carbon capture, and storage technologies, how those can really help to provide for a more stable grid and more energy affordability?

Mr. BRYCE. That is a laundry list there, Senator, but I will take a couple of cracks at it. First, to the issue of natural gas and this push for electrify everything, I do indeed think it is not just a bad policy, it is a dangerous one, and I speak from personal experience. During the February blackout in Austin, my wife and I bought our

house 21 years ago, one of the first things we did was plumb in natural gas. We were 45 hours without electricity but we still had gas, so we could cook. We had hot water. We could keep at least the kitchen warm by turning on the burners.

The idea that we would just rely solely on the electric grid for all of our energy needs, including hot water for cooking, et cetera, for heating, is just a bad idea, and unfortunately we see, in California, now more than 50 communities have banned the use of natural gas in new residential construction and commercial.

It is also a regressive policy, Senator, that the price of electricity on a per-unit-of-energy basis is four times that of natural gas. This was according to a notice in the Federal Register published by the Department of Energy earlier this year.

As far as the other issues that you mentioned, let me just touch on the nuclear because you brought up a lot of issues there. I am adamantly pro-nuclear, sir. If we are serious, and if the Senate, if Congress, if we are going to be serious about decarbonization in the United States we have to get deadly serious about nuclear energy. This is the fifth time I have testified before Congress and I have been consistent over the last 10 years in my testimony before Congress. If Congress is going to be serious about decarbonization we need bipartisan, long-term support for the development and deployment of new nuclear reactors, and we need to preserve and extend the lives of the existing reactors in our fleet.

Senator PORTMAN. I could not agree more, and this new technology is safer, fewer issues with regard to the disposal challenge. And, the rest of the world is going to surpass us unless we catch up on that technology.

Mr. BRYCE. If I could build on that, sir, it is clear that the Russians and the Chinese are the ones that are now leading internationally on the development and deployment of new nuclear. The French president, Macron, just, in the last few days, in response to the gas crisis in Europe, said the French are now going to be deploying small modular reactors. The U.S. needs to get off the dime and move, and move quickly.

Senator PORTMAN. Yes, and we also have an enrichment challenge here in this country. We have only one place that is an American enrichment source, and it is not commercialized yet. It happens to be in Ohio. And so that is the Portsmouth Gaseous Diffusion plant, which is now changing into a centrifuge plant. But we need to get the commercial level of enriched uranium up so that we can have an adequate industry here in the United States.

How about hydrogen—and if anybody else on the panel wants to talk about hydrogen—derived from various sources, including, of course, fossil fuels and natural gas, as one example. We have a plant in Ohio that is doing that on a commercial scale. What is the potential there?

Mr. BRYCE. I will just jump in really quickly, sir. I am skeptical about hydrogen just for several reasons. One is the amount of energy needed to produce the hydrogen molecule. I have done the math many times. It is roughly one and a half units of energy and for one unit of hydrogen out. Then you have a molecule that is very difficult to handle, very difficult to store. We do not have a lot of fuel cells sitting around in which we can use hydrogen.

I understand the discussions but I have been hearing the same discussions about hydrogen now for 20 years. I am happy to admit that I may be wrong, but we have heard this for a long time.

Senator PORTMAN. Anybody else on the panel want to talk about fuel cell technology and where you see it going, hydrogen fuel cells?

Mr. HERRGOTT. Senator, I would just like to point out that the market is dictating the profitability and the ability to determine an return on investment (ROI) on new energy sectors. That is why you are seeing all of the old legacy utilities that previously, where it be a Duke Energy or Dominion, rebalance assets to try and figure out how they can operationalize new sources of electricity to derive a rate payer, whether that be coal, natural gas, hydrogen, you name it.

In many cases the Federal Government does not have a role, except to get out of the way and try and fix this so that the 20 to 30 percent on that project development cost, which we have \$800 billion sitting right on the sidelines, we can actually address the capacity issues rather than looking at efficiencies and microgrids as our only solution, which is triaged to address the fact that we need to double our actual gigawatt output, regardless of where it comes from, 20 percent a year for every year for the next 20 years, to meet overall energy demand.

I do not think we are in a position to dictate to the private sector that funds most of this what energy source they should choose and derive an ROI on.

Senator PORTMAN. Alex, let's talk about the project development cost issue a little bit. We talked earlier, during my opening, about the removal of the sunset on the FAST-41 provision, which enables us to have some more certainty and predictability going forward with regard to the council on ensuring that we are saving money on everything single project that is covered, including a lot of energy projects.

As the former director of the Federal Permitting Improvement Council—and, by the way, I appreciate you inviting me down to participate in some of those council meetings and listen to what goes on and meet with the agency leadership that is involved, from dozens of different parts of our government, it has been really interesting—but what can be done to improve the Permitting Council? How can it be even more effective?

Mr. HERRGOTT. That is a good question. The Permitting Council is not a magic bullet. It cannot compel agencies to meet milestones and meet deadlines in a way in which it supersedes the 30-odd, 60 permitting laws that have been passed over the last 100 years, whether it be the Endangered Species Act (ESA) passed in the 1970s, the Rivers and Harbors Act from 1910. Let's use a tool to coordinate Federal agencies and ensure accountability.

But at the end of the day, the agencies are self-recording, self-selecting their permitting schedules, and what I worry about is there is a tremendous amount of front-loading happening before FPISC ever gets to provide those accountability protocols, which can now be as much as 2 to 4 years before an application is deemed complete, and never makes it on to anyone's sheets. When we are talking about NEPA or NEPA reviews or what the CEQ is doing,

it is about the 60 other permits that happen before and then the land use permits that happen after that delay construction.

There has only been 10 projects out of the 50 this year, and I worry sometimes that the illusion of progress is no progress at all, and I get worried that it will lessen the urgency for us to actually do the hard work because there will be a mission accomplished that if we extend FPISC in perpetuity that we have solved all the world's problems, when, in fact, it is a small piece of the puzzle but an extremely necessary one to exhibit the best practices all agencies should incubate.

Senator PORTMAN. I appreciate your passion for this and your consistent advocacy up here on the Hill, and then at the council, and now in your private sector role. Yes, you talk about, in your testimony, these formal or informal policies to front-load biological, cultural, historical surveys. How do we bring more accountability to that process?

Mr. HERRGOTT. I think most of all it is the idea that many of the Federal regulators do not actually talk to each other. I mentioned one of the projects where, in the Department of Interior, three different agencies within do not talk to each other, nor do they actually understand each other's requirements. There is this rush to meet a schedule without actually understanding that the folks putting these projects forward are not to be treated as adversaries but rather customers. They are the same Americans that are building the broadband, the transmission, the natural gas.

But somewhere along the line the process has gotten so complicated that even I do not understand the documents when they are 10,000 pages long and have another 10,000 pages of appendices. Attorneys should not be talking to attorneys. Scientists should be talking to scientists. That is why my nonprofit, the nonpartisan group is working with Christine Harada, who is the current Executive Director of the Federal Permitting Council. She is doing an amazing job but she is only one person. She cannot make the agencies care about accountability and efficiencies and meeting milestones. She is only one person.

You have to have an activated Executive Branch and an administration that is putting deputy secretaries as council members, in a place to adjudicate the speeds and clear out the communication breakdowns that happen amongst agencies. Unfortunately, I am not sure that is occurring.

Senator PORTMAN. Do you think we have the right people currently sitting on the council? The statute requires members to be deputy secretary or higher, but it appears to me that a number of the members currently are not at that level. Does that raise some practical problems in the Biden administration?

Mr. HERRGOTT. I think the way in which President Obama and yourself and others, when they were enacting the council, and then it was, over the last 4 years, as a truly nonpartisan entity, this is not something that you inject politics into the process. All it requires is that somebody at the top end of the agency, able to adjudicate the speeds, and clear out the disagreeing voices on a risk-based decision on whether a project is a green light or a red light or what mitigation needs to occur. If you do not have that deputy

secretary in that role then it hampers the council and in many cases it makes it ineffective.

Senator PORTMAN. Yes. So you think a more senior membership would be helpful, moving forward?

Mr. HERRGOTT. Senator, the statute says deputy secretaries for a reason.

Senator PORTMAN. Great. Well listen, again, I appreciate your work in this over the years, and Alex, let's keep in touch, and thanks for coming before the Subcommittee today to give us your expertise, and all the witnesses, we thank you on your help on the infrastructure challenges we face.

Thank you, Madam Chair.

Senator SINEMA. Thank you, Senator Portman. I am going to a second round of questions, first recognizing myself and then Senator Lankford for additional questions.

Mr. Herrgott, in your time as the Executive Director of the Federal Permitting Improvement Council, you were able to help over 50 projects reduce their permitting timelines while maintaining the same standards for approval.

With the historic investment in our country's infrastructure in the bipartisan infrastructure package, how can the Federal Government leverage the Permitting Council and its coordination ability to ensure the timely use of these funds?

Mr. HERRGOTT. That is a great question and that is the crux of the reason why we created The Permitting Institute, which complements what Executive Director Harada and the administration are doing at the Federal Permitting Council. However, the reason why only 10 projects have joined FPISC this year is many of the offshore wind projects, \$70 billion worth, 13 projects in total, that have the ability to generate a 150-baseload electricity within 6 to 7 years from now, with the appropriate energy storage capacities, they are still awaiting, in this construction operational management, pre-planning before they even get to NEPA 3 years from now.

And so casting transparency on the entire project development lifecycle, without a lot of hyperbole from our flanks, make it difficult to pick up the veil and actually look at why projects are not being constructed is why FPISC permanence is important, because they plan integral role in bringing best practices and transparency to the systemic issues that continue to be ignored and that continue to push new investment on energy further into the future.

It is extremely important that we support them, that the administration supports them. We have also got to take a hard look at the 60 other laws that are underlined within agencies or else FPISC is a fig leaf, and a fig leaf of a solution is no solution at all.

Senator SINEMA. Thank you. Turning back to Mr. Esquerra, throughout your career of promoting economic and community development for Arizona's Tribes you have noted the high number of Federal requirements that are necessary to accomplish any economic development project. By granting Tribes, Alaska Native corporations, and Native Hawaiian organizations expanded access to the coordinating benefits overseen by the Permitting Council, how

can Arizona Tribes best access economic development opportunities that take advantage of this provision?

Mr. ESQUERRA. Thank you for that question. As I previously said, I just think, opening up the funds to make it a level playing field with the States. I think the other thing that people need to realize is the Tribes, their basic infrastructure, even when it comes to energy, we are far behind on what is currently out there. There has been a discussion of what happened in Texas. The Hualapai Tribe, when they have electricity go out it is not for 2 or 3 hours. It is for 2 or 3 days at a time—that is the average norm—because they only have one electrical line going in. They are in the process of putting in a loop system, but they have been struggling, going through the process. I think now they are in month 32 or 33, trying to get a loop system in place just so they can offset some of the issues that happen when power goes out in that community. That is nothing new with most of the Tribal communities in Arizona.

I think the biggest thing, like I said earlier, is building the capacity of the Tribes themselves but also those Federal agencies when they engage with the Tribes. It is so important to have that relationship. I talked about how you can develop that relationship, but it takes time and some patience. But truly, if you really want to work with Tribes, engage with Tribes, it is that understanding of what makes them unique in their culture. Thank you.

Senator SINEMA. Thank you. Moving now to Mr. Yonker, innovation is a critical component of strategic planning and preventing grid outages. Two of our Arizona utilities are undertaking this type of work. Salt River Project has started work to develop an integrated system plan which will allow it to integrate new, renewable, and distributed resources and more effectively respond to changes in low growth with the growth of electric vehicles and electrification.

Tucson Electric Power has partnered with military facilities, the Davis-Monthan Air Force Base and the Fort Huachuca Army Base to reduce single grid points of failure and ensure critical load continuity with enhanced grid infrastructure.

What steps can we take to encourage these types of activities in other regions?

Mr. YONKER. Great question. Historically, electric grid operators have not been incentivized to innovate or try something that maybe does not work. The rate of R&D investments by utilities versus basically all other industries is negligible.

I would say that a culture of accelerating innovation must become a core competency of electric grid operators as they move into the 21st Century. They should not fear things like virtual power plants. They should be experimenting with real-time monitoring and machine learning applications to pinpoint issues.

A couple of examples, specifically. One is local but Federal support and signals could help. The idea of a regulatory sandbox is a great way to put guardrails and restrictions, to some extent, as State regulators work in partnership with the utilities that they are regulating. I would even be more supportive of more aggressive ideas, where utilities have upside potential if things go well while they are innovating, and maybe they even share those with some other stakeholders, those benefits, federally, competitive grants,



like those in the bipartisan package, are at the core of making these solutions available, where new innovations can be experimented, and the risk or the opportunity to try something new can be shared amongst other capabilities. Then DOE and the agencies and the partnerships that they have to commercialize is just central.

Senator SINEMA. Thank you. Mr. Herrgott, improving redundancy is an important part of creating an electrical grid capability of satisfying demand, especially as we continue to develop an all-of-the-above energy strategy. How do we best harness our improvements to the permitting process to create a grid better able to function during extreme weather events and surging demand?

Mr. HERRGOTT. Thank you. It is important to note that more than 90 percent of all transmission lines across the country are close to 70 years old. When we talk about the capacity needs they far outweigh the efficiency needs. The efficiency needs are the triage because we have not had the investments in the actual transmission because there has not been the kind of offtakers.

But also are in a new situation now where the wind, solar, and even the dual fire power plants that might be natural gas and coal, are located in areas that were economically feasible but now require a 300-mile connection to bring them to the place where the energy is actually needed. There is a fundamental disconnect between Federal regulators that have never actually built a project before and are unaware, in many cases, of the financial development and legal risks that these companies are jumping off the cliff to provide for this country.

The reality here is the very Princeton study that Secretary Granholm brings up with the 22 transmission projects that are shovel-ready. Twelve of those are actually not shovel-ready—they are in a standstill with no resolution in sight—but we keep talking about them being shovel-ready.

It is very difficult to talk about redundancy and resiliency when we have close to \$120 billion right now of projects that are both inactive, permitting, they are at a standstill, and are looking at potentially abandoning the project, a big one in Arizona, in particular, and that is just something that we need to shine a light on, because those folks are going away. There has to be an incentive for people to put capital risk to build energy assets. The government is not going to do it for them.

The confluence of the Federal Permitting Council, your work in the bipartisan package on the grants, and then also actually give them the real help that they need, by fixing the underlying complicated nature of all the 60 statutes that are inside and outside of NEPA, are essential. Otherwise, what are we doing here?

Senator SINEMA. Thank you. My last question is for Mr. Nickell. Extreme weather, including heatwaves and record low temperatures, have strained regional electric grids across the country, and at the same time the Federal Government is weighing investments in electric vehicles and conversions to electric heating. Now these investments would increase the nation's electricity use at the same time that siting new transmission lines has proven challenging.

With the need to increase grid capacity and reliability and efficiently connect energy production with use, how can we upgrade

and expand both our transmission and distribution grids across the country?

Mr. NICKELL. Madam Chair, what I would begin with is we have to make sure that we have willing investors. We have to make sure that we have an independent body or bodies that oversee the development, the approval, the regulatory approvals of the most effective and optimal projects.

In SPP, we are rich in a lot of resources. We have 94,000 megawatts of nameplate capacity to serve 51,000 megawatts of peak demand. What we have to do a better job of is making sure that that capacity is deliverable and that it energizes and provides energy when it is needed the most, and then we have to have effective and optimal transmission assets that are needed to deliver that.

A regional transmission organization—granted, I am partial to that; I am a big fan of regional transmission organizations—those are the kinds of organizations that can achieve the collaboration and the engagement of large groups of participants, they can do it in an independent way, and make sure that the right and the most optimal transmission is provided and enabled.

We also do not have any advocacy or picking and choosing over resources. Those resources are developed by the utilities, and they do that because they have customers that ask for those resources. Whether it is wind, solar, whatever, they have customers that are driving those decisions and they have their own analyses that determine what is cost-beneficial for them to invest in. But at the head of that you really do need somebody that has independent oversight in making sure that the appropriate transmission infrastructure is also being built to facilitate the reliable delivery of those assets.

Senator SINEMA. Thank you. Senator Lankford, I would like to recognize you for a second round of questions before we close out our hearing. You are recognized.

Senator LANKFORD. Thank you very much. Mr. Nickell, I want to be able to follow up with one last question on this. There is a lot of conversation on the price of natural gas during last February's storm. You brought that up as well. There are a lot of market features that are there with supply, demand, the contract, the spot price, all of the stories, as we talked about before.

But an odd question for you that I hope there is an answer to. How did it get to that price, the final price that it got to for natural gas? Why was that the final price? Because you all were dealing with the different costs for natural gas during that time period, how did it get to that spot?

Mr. NICKELL. Ranking Member Lankford, I do not know the answer to that question. There are certainly a lot of anecdotal pieces of information that I have been shared, but I do not know the whole story. I have heard that the lack of supply created the demand. I have also heard that the willingness of generators and utilities to pay what they could afford to pay in order to reliably serve load also contributed. But I cannot tell you to what extent either of those drove that price as high as it did.

Senator LANKFORD. That is one of the features we are going to have to determine at some point. Obviously, ERCOT was ready to

pay a pretty high price to be able to get some natural gas. It drove up natural gas prices everywhere else when people were dealing with it. If there is one area that I think you and I need to be able to follow up on it is this process of what is the combination of contract firm price, spot prices, and what is the dependency there and what percentage will be there, what amount of storage has to be there, and then how do we manage the price.

Obviously, I am not one for price controls in this process. I do know our electricity has some price caps that are in it. We have to be able to figure out how to be able to manage that long term, because we will have other peak events, both summer and winter events, and this will be in different regions as well, and the lessons learned from last February would be helpful to other RTOs across the country.

Mr. Bryce, I do want to be able to drill down on something you had mentioned before about nuclear power, and we have to be able to get that as a power source ongoing. That is not happening right now, with small, modular, or nuclear power. The reason that I hear most often is the cost and the investment there, and the capital that is required to be able to do that, in initially, and the second issue has become the permitting, that no one wants to put \$8 billion forward to be able to prepare for a nuclear power plant if it is going to take 15 years in permitting and the uncertainty of who will be President and what the rules will be when they actually get to that spot.

Is that correct? Not correct? What do you think is the reason we are not seeing more nuclear power at this point?

Mr. BRYCE. Senator, thank you. I think you have hit on those exactly in the right way, that as Ray Rothrock, who is a veteran venture capital investor, has recently said, the Nuclear Regulatory Commission (NRC) and the Federal Government present, in terms of the licensing, an uncontrollable risk for investors who want to build new nuclear plants, and the length of the licensing process is a gigantic hurdle.

We have also had the recent experience of the nuclear plant in South Carolina being canceled. Plant Vogtle in Georgia is overtime and over budget. I think it is clear, as well, that those plants, and generally speaking, are just too large. We need smaller reactors that are going to be lower cost, that we can build at scale, and do so quickly.

I have written quite a lot about this. I have had several guests on my podcast talking about how do we scale up a new nuclear manufacturing sector in the United States. Robert Hargraves has a company called ThorCon. His idea is to fabricate them in shipyards.

But if I may, and to refer to your question back to Mr. Nickell, I would like to make one point on the gas grid and the electric grid. In August, I published a piece in the Dallas Morning News about what happened in ERCOT, and I made point in that piece, and I want to reiterate it here, the natural gas grid and the electric grid in the United States have merged, but they are still being regulated separately. And your point about maybe requiring or incenting electric utilities, electric generators rather to have some amount of firm capacity I think is part of the answer. In know the

Public Utility Commission of Texas is grappling with these issues now, trying to figure out how they assure the on-time delivery of natural gas during peak events.

But we have to also understand that one of the reasons why we had such a high peak demand in Texas during Winter Storm Uri is because over 60 percent of the homes in Texas rely on electricity alone for heating. So that peak would not have been as high if we had had more homes using natural gas.

But I think that the fundamental issue, in terms of that resilience, reliability, and when it comes to natural gas and the interface with the electric grid is that those grids have to be more closely regulated or the regulation has to be intertwined, because those grids are interdependent.

Senator LANKFORD. Thank you. That is helpful.

Mr. Herrgott, I want to ask you the same question about the nuclear power and the permitting process there. You have mentioned multiple different projects that are transmission projects that are quote/unquote “shovel-ready,” that everyone knows they are actually not shovel-ready out there, that they have been a decade or more in processing and they are currently stuck with competing Federal regulations or competing Federal requirements, preventing them from actually going forward.

Any time I talk to anyone about nuclear power they bring up the same issues—why would I take the risk in \$8 billion in capital if they cannot even get transmission lines up and going across multiple States to be able to move? What do you see as the biggest barriers in the permitting side for nuclear?

Mr. HERRGOTT. Sure. So first of all we have to desegregate the two discussions about whether or not wind and solar, at any point in the future, can provide baseload by having energy storage so it can meet the demand response at any given time. We are still years away from that, especially where the development of the projects are now that are stymied, even though there are billions in private equity and investor-owned utilities and then public utilities that are putting money behind it.

When it comes to developing new nukes, like we did with several projects while I was at the Permitting Council, even modest reductions in permitting times and increases in predictability and hard milestones had a direct relational correlation with a 2 to 3 percent increase in the debt and equity costs for these large owners, which are many times spread across multiple utilities.

At the bottom line it is this. We have to be rational adults and look at the entire project schedule. The first 2 or 3 years are design and planning, the access and the supply, fuel loads, especially like where Palo Verde and others in Arizona are still able to achieve those. Then there is the competing threat of whether or not, after 6 or 7 years, developing a 700-, 800-, 900-megawatt nuke plant are the off-shore wind plants that are going to be able to do 1.2 gigawatts and are going to have cables that are going to land in the energy storage facility that is going to make this initial investment economically unfeasible.

We are in this notch period. All this frustration and policy about wind and solar versus natural gas, and everyone talks about above the board, all-of-the-above energy solutions. We need it all, and the

bottom line is that at the end of the day our job—not my job, potentially those that are policymakers—is to remove the headwinds and let the market dictate where the energy price and spot demand markets are going to end up, without manipulations.

Although folks talk about the subsidies of the ITC and the PTC, that is about 2 percent of the benefit that can be a subsidy for a new plant. The 20, 30 percent of project process costs that is borne on the backs of the eventual rate-payers, is the big issue, and nobody seems to want to fix that. That just ends up rolling off the backs of these utilities that pass it on.

Senator LANKFORD. OK. Mr. Bryce, quick question on this. What do you estimate of the cost for new nuclear modular, and how many of them would it take to replace coal in the United States? Because I hear that frequently being kicked around that we will replace all the coal facilities with nuclear, and so I am interested in what is the cost per of those facilities right now. We have already discussed the decade or more in permitting it would take to be able to do each one of those. What is the cost for each one of those right now, and then how many would you actually have to build to replace coal in America?

Mr. BRYCE. You are testing my memory here, Senator, but I think the goal should be, for new nuclear reactors, that they should be at par with new natural gas, which is about \$1,000 per kilowatt. So \$1 million a megawatt is rule of thumb, generally speaking, for new natural gas-fired power plants.

As far as how much the existing coal capacity in the United States—now you are really testing me because our coal-fired capacity has been declining rapidly over the last few years. The last time I looked, I think we are consuming about as much coal for electricity in the United States as we were in the 1960s, although the Energy Information Administration (EIA) just did say that we are going to set a new record high for coal-fired generation this year, taking us back to where we were in about 2014.

But I think we would need at least 200 megawatts but probably more if we are going to, if memory serves, replace existing coal in the United States.

Senator LANKFORD. How many facilities would that be, 200 megawatts to replace coal?

Mr. BRYCE. Of course, it depends on what size reactor is deployed, sir, because now you have companies like Oklo who are developing a 1.5-megawatt electric reactor, a very small reactor. Some of the other reactors are in the new scale. I have forgotten what that is, a 20- or 30-megawatt electric reactor that can be built in what they call a sixpack, I think, configuration.

But that is the key challenge, sir, is just what is going to be the optimal size for these new reactors, and what is the market going to demand.

I will make one other quick point here, which is that what makes entry of new nuclear into the market in the United States difficult is that electric consumption in the United States has been flat for 15 years. We are at a different point today in the United States than where we were in the 1950s, 1960s, 1970s, and 1980s, when essentially all of the nuclear reactors in the United States were built, where we were seeing high single-digit increases in electricity

demand in the United States. But over the last 15 years, despite population growth, electric generation in the United States has been flat, at about 4,000 terawatt hours a year.

Senator LANKFORD. OK. Mr. Bryce, let me drill down on one other concern that we have all got, and we are watching on this as well. Europe and in many parts of Asia they are dealing with availability of electricity right now, and they have had a pretty significant challenge in multiple different areas in Europe, and across China we are watching that. We are also watching in India, the capabilities.

What are the key features that you see there, in Europe, China, India, where they do not have enough electricity right now to be able to supply demand? What do we need to pay attention to there to make sure that we do not have that here?

Mr. BRYCE. My response, sir, was I think what we are seeing is what I call the “iron law of electricity,” which is that—and this is based on what I have seen traveling around the world over the last 5 years, India, Iceland, Lebanon, Puerto Rico, New York, Colorado—people, businesses, and countries will do whatever they have to do to get the electricity they need.

What we are seeing in Europe is a return to coal in a big way, because natural gas is so expensive. We are seeing spot prices of coal in the international market now, for the Newcastle benchmark at over \$200 per ton, and in China, in some cases, over \$300 per ton. We are seeing the deindustrialization across Europe because of a lack of natural gas. You see fertilizer plants being shut down, which will have knock-on effects in the slaughterhouses, knock-on effects in food supplies in the coming years because farmers do not have enough fertilizer.

This is due to under-investment in hydrocarbons. Now this is not a popular view, but this is the reality. The world still runs on hydrocarbons, and now we are seeing that without there being enough natural gas, Europe is in crisis, and it is affecting multiple industries where steel producers, limited producers in China are shutting down. We are seeing the knock-on effects from not a lack of renewables but a lack of hydrocarbons.

Senator LANKFORD. Thank you for that. That is helpful, to be able to get a context on.

Again, this particular Subcommittee we deal with the issue of energy diversity to try to make sure that the United States maintains a diverse energy portfolio that works and that is reliable and that is resilient enough to be able to manage it. We have obviously seen some gaps in our resiliency in multiple areas, with blackouts and things that are happening in California, with what has happened in the Great Plains and the Midwest in the storm Uri last February, and we have seen it in other areas as well. We are going to continue to be able to work on this.

Mr. Yonker, I have one last quick question for you as well, and I am going to call you out on something. When there was a conversation on hydrogen earlier I was kind of watching your expression as I am watching through the Brady Bunch boxes that I have on my screen here, and I can see your expression when hydrogen was being discussed as well. Is there anything that you would want to be able to contribute as well on the issue about hydrogen?

Mr. YONKER. I have not studied it enough to have an opinion on hydrogen, but I certainly think that other grid flexibility solutions at scale ought to be getting prioritized. We talked about demand side management. We have not really talked about long-duration storage which is stuck in early commercialization between labs and other areas.

I think there are some solutions from a grid flexibility and a grid reliability standpoint that need significant investment, where the Federal Government can play a really important role, and this, in many ways, might be commercialization from the labs, this might be in grant programs, like that are stuck in the approved but yet appropriated Energy Act of 2020.

Senator LANKFORD. Thank you. Chair Sinema, thank you for the additional time and the second round of questions. I appreciate that. For all of the folks that are testifying today, we very much appreciate not only your written testimony that you submitted but your oral testimony as well, and I appreciate your engagement on these issues. It is much needed in this season, as we deal with a lot of very complicated issues right now.

Senator SINEMA. Thanks so much. Thank you, Senator Lankford, and thank you to all of our witnesses.

With that we have reached the end of today's hearing and I appreciate all the witnesses today for your time and testimony. I want to thank all of my colleagues for their participation.

This was a very important and a timely hearing, and I know there were a lot of questions that not everyone had an opportunity to ask. I will be submitting additional questions for the record so we can continue to examine this critical need.

As 15 days from today is Veterans Day, the hearing record will remain open for 16 days, until 5 p.m. on Friday, November 12th, for the submission of statements and questions for the record.

With that I will adjourn this hearing. Thank you.

[Whereupon, at 3:26 p.m., the Subcommittee was adjourned.]





## A P P E N D I X

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**Senate Committee on Homeland Security and Governmental Affairs, Subcommittee on  
Government Operation and Border Management  
Hearing: Strategies for Improving Critical Energy Infrastructure  
Opening Statement as Prepared for Delivery by Chair Kyrsten Sinema**

**October, 27, 2021**

Today, we are examining Strategies for Improving Critical Energy Infrastructure in the United States. This topic represents a key issue for Arizona, Oklahoma, and the rest of the nation. Our businesses, communities, and families need a reliable energy grid to succeed.

However, this past year has brought severe weather and storms to every corner of our country – leaving families victim to the elements when the electrical grid goes dark.

These outages present a financial cost to American families and businesses, with the American Society of Civil Engineers estimating that power outages cost U.S. data centers \$8,851 for each minute of a disruption, and that the cost of each outage results in \$42,000 in losses for the manufacturing sector. These outages also lead to deaths – and while sometimes grid failure is unavoidable – even one death is too many.

I support an all-of-the-above energy approach that maintains reliability, affordability, and safety. That is why I was proud our Bipartisan Infrastructure Package includes funding for grid infrastructure, resiliency, and reliability. New money to support supply chains and clean energy technology, including battery research and manufacturing; and investments in fuels and technology infrastructure – including CCUS, hydrogen research and production, a civil nuclear credit program, and hydropower efficiency incentives.

Finally, we were able to make the Federal Permitting Improvement Steering Council permanent, and expand access to Tribes, Alaska Native Corporations, and Hawaii Native Organizations, so projects that improve America's energy infrastructure can be completed without needless delay.

In Arizona, we are proud of the progress our utilities have made to utilize cleaner energy sources. My state has been a leader in integrating "demand response" into the grid, which has been a key component in maintaining grid operations and affordable pricing during the increasingly hot summers of the past two years.

Arizona also has the highest solar potential in the nation, and I have supported the growth of the solar industry and the economic opportunities it brings to Arizonans. However, I recognize the challenges an intermittent resource like solar can present. This is why I support increased investments in battery storage and implementing technologies that enhance grid flexibility and resilience.

By utilizing these programs, such as the Permitting Council, and funds made available through our bipartisan work to improve America's infrastructure, we can make sure that extreme weather events do not cost Americans money, and more importantly, that a grid failure does not result in death.

Opening Statement  
Hearing before the Government Operations and Border Management  
Subcommittee  
Wednesday, October 27<sup>th</sup>, 2021, at 2:30pm

- Good afternoon. I want to thank Chair Sinema for holding this timely hearing on the importance of grid reliability and ensuring we have an adequate energy supply.
- As many of you know, last year Oklahoma and much of the country faced unseasonably extreme cold weather and winter precipitation that challenged our grid and energy supply, and left many in the dark and without heat during the coldest time of the year.
- I frequently say that Oklahoma is the Saudi Arabia of wind since we get about 40% of our electricity from wind annually. But during that period of time last February, despite all of our wind infrastructure, wind fell off the grid like a switch had been flipped. Meanwhile, coal, which usually contributes less than 20% of our generation, shot up to provide over 50% of our power.
- Oklahoma truly is an “all of the above” energy state, and I believe this emphasis on energy diversity is why the impact in Oklahoma was not worse than it was. I look forward to discussing what went right and what went wrong, as well as what we can do better in the future, Mr. Nickell.
- This conversation about energy reliability is particularly timely as the global economy continues to reopen and we head once again into the cold winter season.
- Unfortunately, we may be getting a preview of what is to come. In recent months, we have been watching as our friends across the Atlantic have been struggling with an energy shortage. In the UK, a lack of reliable wind generation and high natural gas prices have forced energy-intensive factories to close or pass along steep cost increases to consumers.
- China, too, has been battling an energy crisis. Emissions targets and a coal shortage have resulted in power cuts in at least 20 provinces. The impacts have been widespread, from halting factory production to turning off traffic lights in some communities. China is now aggressively working to secure coal supply to alleviate this crisis in the short-term.
- Last year’s extreme cold weather and the recent experiences of other regions of the world should be a wakeup call for all of us about the fragility of our energy infrastructure and a stark reminder that the energy policies we adopt matter to our everyday lives.
- Congress is currently considering legislation that would dictate to power providers what their power generation mix should be. If they do not meet specified targets for renewable generation, generators would be fined.
- Congress is also considering extending renewable energy tax credits for another ten years. Some of the generation sources that qualify for these credits, like wind, can already compete in the marketplace on a cost-basis without taxpayer support.
- These distortions to energy markets have the power to impact all Americans. I am concerned that incentivizing a wider adoption of intermittent generation sources and discouraging investment in true baseload infrastructure will be to our own peril. Last winter we were lucky that we had coal units we could call on, but this may not be the case as more and more coal and nuclear plants retire.
- I want to thank all of the witnesses for joining us and look forward to the discussion.

Written Testimony of Alexander Herrgott President and  
CEO, The Permitting Institute

Before the Subcommittee on Government Operations and Border Management  
of the U.S. Senate Committee on Homeland Security and Governmental Affairs

**Strategies for Improving Critical Energy Infrastructure**

Wednesday, October 27, 2021

2:30 p.m.

Via Videoconference

Chairman Sinema and Ranking Member Lankford, my name is Alex Herrgott, President of The Permitting Institute (“TPI”). TPI is a Washington D.C.-based non-profit, non-partisan organization actively engaged nationwide, whose purpose is to accelerate the modernization of America’s aging infrastructure while protecting our environmental, cultural, and historic resources. I appreciate the opportunity to discuss targeted actions Congress can take to remove permitting obstacles blocking expansion of affordable, reliable, and resilient energy infrastructure.

Congress must address and unravel the bureaucratic gridlock faced by new energy and infrastructure projects. Without action, escalating national household and commercial energy costs will cause serious economic harm, both now and in the future.

Volatility in energy markets continues to increase as the country transitions from conventional to renewable energy resources. Many of the renewable energy projects needed to meet this Administration’s greenhouse gas emissions targets remain in various stages of planning and development. Simultaneously, some conventional energy generation sources, such as coal, are decreasing production or being retired early. This mismatch between planned generation and generation retirement are causing supply and demand issues that are responsible for rapid increases in global energy costs.

These increases are expected to worsen this winter, especially here in the U.S. Analysts predict that a colder than expected winter could trigger a 25% jump in U.S. natural gas and home heating costs. Presently, the U.S. oil benchmark, West Texas Intermediate, is closing in on \$85 per barrel, a price not seen since November 2014. Deutsche Bank recently wrote, “The importance of these moves on inflation, growth and external accounts are not to be underestimated. These price moves are a big

deal.” An equally big deal is the \$600-\$800 billion in private investment for new wind, solar, transmission, storage, and carbon capture waiting on the sidelines for clarity and certainty. Those investments, if realized, can help add 200-300 GW of utility scale renewable energy generation capacity to the grid, the equivalent of the electricity needed to power approximately 30 million homes. These “big deal” numbers are further informed by an April 2021 report by Grid Strategies LLC, released during a Department of Energy event, that shows 22 shovel-ready transmission lines that would deliver renewable energy to market but are stalled in various phases of the permitting process, with no resolution in sight.

Accordingly, project developers and TPI members are hesitant to invest due to the fact that projects initiated today will not be realized for 7-to-10 years. As this summary timeline articulates, our nation’s permitting system does not solve problems, it creates them. To illustrate:

- **2-to-3 years** of project design, engineering, permitting, planning, and financing
- **2-to-4 years** of formal permitting process submission and review – a timeline that pushes orders for new windmills, solar panels, transmission lines, charging stations, construction equipment, steel, concrete, and labor contracts years into the future.
- **2-to-3 years** of construction – this assumes permitting approvals are granted and supply chain orders are aligned

Despite these challenges, I am here today to shine a light on near-term opportunities for progress. Many obstacles impeding the energy projects required to meet President Biden’s emission reduction targets are avoidable; and they must be avoided to have any hope of reaching the Administration’s ambitious goals. Reaching net zero emissions by 2050 will require more than 200 GW of generation capacity, which means we must double last year’s record-breaking annual growth in renewable energy generation and then maintain that rate of growth year-over-year consistently for the next decade, in addition to other decarbonization efforts and advances in technology.

TPI members, and members of this committee, know all too well that energy projects are routinely stymied at various phases of project development by disconnected and fragmented federal and state review processes. Permitting processes are marred by contradictory rules, timelines, and policies

that cause delays, cost overruns, and in some cases, project abandonment.

Each of these permitting problems are exacerbated by the lack of government accountability inherent in the federal permitting system. We have a system that has allowed agencies to sit on applications for decades, in some cases, with no promise of project approval on the horizon. While the focus in most permitting timeline discussions often centers on the National Environmental Policy Act (“NEPA”), NEPA is just one procedural hurdle among more than 60 possible federal permits that may be required, spread across 13 federal agencies, not including a myriad of state and local permitting obligations.

Many otherwise “shovel-ready” infrastructure projects spend years in bureaucratic gridlock. Developers routinely find themselves struggling through the informal pre-permitting, planning, and application process – again, often for years – with extensive ongoing submission and review cycles before equally cumbersome formal NEPA processes commence. Consider these examples:

- Multiple offshore wind projects, including Skipjack, Mayflower, and Bay State, even after becoming a clear priority for the Biden Administration, have yet to receive a preliminary permitting timetable from federal agencies, even for those projects who are statutorily required to have a permitting timetable.
- Proposed renewable energy projects on federal lands continue to face project delays and cancellations. Noted problems within the federal permitting process are exacerbated on federal lands due to the Bureau of Land Management’s (BLM) staffing decreases, the closing of its national project manager program, and its “prioritization” policy that keeps projects in limbo.
- To make matters worse, some agencies have identified new formal or informal policies over the past several years to frontload preliminary biological, cultural, and historical survey requirements prior to formally starting the review process—pushing the starting point even further into the future. In some cases, frontloading project pre-planning increases efficiency and substantial discussion early in the process, but in others it creates unintended and unpredictable obstacles to additional investment while “hiding” the full duration of the

permitting review process timelines.

- Project delays can stem from the sheer number of federal, state, and local agencies and their diverse permitting requirements. One egregious example is a \$3 billion project investment in a clean energy transmission line that began the permitting process more than a decade ago. The project endured seven years of review and was finally deemed “complete” by the federal government four years ago. However, it is now entangled in court proceedings because one of 49 participating government agencies pursued a separate programmatic workflow that renders the prior approval moot. That is \$3 billion in clean energy distribution delayed for more than 10 years because one hand did not know what the other was doing – within the same federal agency.

These are just a few of the hundreds of examples of project delay and cancellations that come from the U.S. permitting process. Each example points to the urgent need to repair the outdated and sclerotic permitting system that keeps the country from meeting our growing energy demands. Most major U.S. infrastructure investments in wind, solar, carbon capture, hydro, geothermal energy, broadband, electricity transmission, oil and gas pipelines, supply chain port expansion, and export development are entirely supported by U.S. companies in the private sector. Energy and infrastructure investors require predictability and prompt decision making when putting capital at risk. Unfortunately, investors are too often treated as adversaries pitted against federal regulators rather than as partners in rebuilding the nation.

Despite bipartisan agreement that the country’s permitting process is broken, outside stakeholders, each prioritizing their narrow interests, are inhibiting additional reforms. But there is a path forward.

Lawmakers should build on, and expand, the reforms enacted over the past decade. Perhaps the most notable accomplishment was the creation of the Federal Permitting Improvement Steering Council, a voluntary program for project developers charged with identifying best practices and implementing basic project management practices across 13 federal agencies. Additionally, the “One Federal Decision” framework enhances coordination among agencies with the goal of completing NEPA review for major projects in an average of 2 years.

Recent reforms have brought positive, yet incremental, transparency and showed promise in reducing average permitting timeframes. However, it is critical to note that those reduced average timeframes are just the tip of a massive permitting iceberg. They do not capture all associated phases of the project development life cycle, the years of early engagement prior to formally commencing review under NEPA, or the years that can follow the Record of Decision, which includes NEPA but does NOT address the required permits to procure land lease and use permits or authorize the project developer to commence construction. In short, these reforms improved permitting processes but also illuminated how many more opportunities remain to address the root cause of permitting delays and obstruction.

The negative consequences of only addressing parts of the process are easy to see. On average, project developers report that 20 to 30 percent of total project funding is wasted by unexpected delays and the resulting cost overruns that create an enormous disconnect between the funding Congress provides and private sector invests, and the ultimate delivery of the infrastructure America needs.

The cost of these pauses and restarts are rarely considered by lawmakers but estimates of the financial impact for major energy infrastructure projects begin at \$50 million per month in lost revenue. Add \$32 million per month in lost retainers on heavy machinery, architects, engineers, and construction crews who either sit stagnant or are reassigned to active jobs. Finally, tack on another \$50 million in annual costs as project sponsors adapt to shifting permitting goal posts requiring additional studies and mid-project redesigns, broken contract penalties, interest on purchased materials along with financial consequence of delays. That cost is ultimately passed down to citizens, either through taxes, tolls, or increased rates and usage fees.

One canard blocking progress is the notion that greater efficiency means fewer environmental protections. This is simply false. TPI is building a large coalition of diverse entities committed to achieving a balance between progress and protection. We are working with developers in every affected industry sector, officials at all levels of government, Tribes, non-government organizations, and community leaders to identify permitting “wins”. But to achieve this balance we must untangle the web of overlapping regulatory and statutory requirements, some enacted over 50 years ago, as we update and strengthen our permitting processes to meet America’s 21st

century energy and infrastructure challenges.

Congress can fix permitting problems by starting small with the creation of temporary initiatives to test new policies in the field under conditions ideal for compromise. One very achievable near-term step is to create a seven-year expedited permitting pilot program for a discrete list of the most critical projects, with focus on coordinating across all regulatory entities. Granting such an essential, yet temporary, new authority will create room to experiment with innovative and expedited permit authorizations. Outcomes can be scrutinized and studied by Congress for feasibility, then converted into more lasting reforms across all sectors.

It will not be hard to develop a list of priority projects. Just consider the offshore wind industry, which has more than 20 projects worth \$70 billion waiting to begin permitting reviews. (In many cases, review timeframes have already been extended within months of a project's initiation.) Add 22 electricity transmission lines that could deliver a 50 percent increase in U.S. wind and solar power but are struggling to get started. Major solar projects that are viable at utility scale could also be prioritized, along with critical mineral or rare earth mining projects that would bolster both U.S. mineral supply chains and national security. To ensure that a pilot program yields representative data across project types, Congress would also want to identify and study the pilot's impact on gas and water pipelines, broadband, railways, and port expansion projects.

TPI is also working to expand the permitting-council model to state and tribal governments, emulating the success achieved in Arizona earlier this year. New state coordinating offices bridge the information and communication gap between state and federal regulators. States, local governments, and Tribes often have numerous overlapping permitting responsibilities and they are rarely coordinated efficiently. State, local, and tribal permitting requirements are often best addressed in the field where the project is located, equipped with critical firsthand knowledge and expertise about local resources. State permitting councils will allow local governments to bring the federal government to the table early in the process.

To be clear, opportunities for progress are directly in front of us. The creation of FPISC and improvements offered in the "One Federal Decision" framework were just the first steps. Meaningful next steps to modernize and expand our energy infrastructure require that Congress



enact comprehensive reforms that extend beyond NEPA to eliminate avoidable delays at all phases of a project.

A project development cycle of 7-to-10 years is simply too long. Working together, we can advance permitting reforms to build 21<sup>st</sup> Century infrastructure that safeguards communities, protects the environment and cultural resources, creates jobs, and brings prosperity to every corner of America.

Committee on Homeland Security and Governmental Affairs  
 Subcommittee on Government Operations and Border Management  
 Hearing: *Strategies for Improving Critical Energy Infrastructure*

Statement of Bryce Yonker  
 Executive Director & CEO of Grid Forward  
 Before the United States Senate

Wednesday, October 27, 2021

Thank you Subcommittee Chair Sinema, Ranking Member Lankford, members of this subcommittee and esteemed colleagues for this opportunity. Talking about the important topic of grid resiliency and critical grid infrastructure is unfortunately not something that gets enough serious attention outside of often passing headlines. And I appreciate the opportunity to be with you to discuss this topic.

My name is Bryce Yonker and I am Executive Director and CEO of Grid Forward an industry organization of more than 100 members from electric utilities, technology companies, universities, national labs, non-profits, and other advanced grid industry stakeholders working to accelerate grid modernization and innovation.

#### **Under-Investment in the Face of Overwhelming Changes**

The establishment and expansion of the electric grid network for developed nations—not the Apollo moon mission, the internet, nor development of cars or airplanes—was named most important achievement of the 20<sup>th</sup> century by the National Academy of Engineering in 2000.<sup>i</sup> The electric grid is the backbone by which we build and sustain our communities, business and indeed society, especially given our digital-driven lives.

However, we are not investing in our grid nearly enough to meet the demands we place on it. As the briefing for this hearing notes, the Association of Civil Engineers gives our electric grid a rating of a C- and predicts that in less than 8 years we will have under invested in the grid by about \$200 Billion.<sup>ii</sup>

With this reality, we are not surprised by the devastation to the grid over the last nine months from overwhelming events that brought new language into our vernacular such as polar vortex or heat domes.

- **Winter storms** in the Northwest<sup>iii</sup> and South<sup>iv</sup> U.S. caused widespread outages during frigid weather, costing billions in damages and a loss of hundreds of lives.
- **Unprecedented heat events** in the Western U.S. caused hundreds deaths and unprecedented need for air conditioning and energy demand<sup>v</sup>.
- **Wildfires** in the Western U.S. disrupted transmission lines<sup>vi</sup>, destroyed communities, and displaced thousands, burning 6.5 million acres to date<sup>vii</sup>—once again costing billions in damages and loss of many lives.
- A pipeline **cyber-attack**<sup>viii</sup> disrupted economies and daily lives across the East coast.
- **Storms** in Gulf States<sup>ix</sup> that tracked into the Northeast cost many lives, destroyed infrastructure—and are forecast to only get more devastating.

The National Oceanic and Atmospheric Administration (NOAA) reports that 2020 had the most weather related disasters in history from 22 events costing the U.S. \$100

billion and that the U.S. has had 18 climate and weather disasters so far in 2021 that each cost the U.S. communities more than \$1 billion in damages.<sup>x</sup> A detailed Washington Post article earlier this week outlined how states are struggling to keep up with grid resiliency investments, citing among other areas that the average American household is out of power 8 hours each year more than double the level only five years ago.<sup>xi</sup>

The price tag of climate impacts is enormous, and going up. The recent International Climate Change Partnership (ICCP) report did not mince words in the threats and impacts that lay ahead in the coming years.<sup>xii</sup> The cost of inaction will pay compound interest in the years to come.

Added to the climate pressures on our electric grid, market dynamics are changing faster than ever before<sup>xiii</sup>. Customers are buying into energy options<sup>xiv</sup> ranging from controlling their energy use with smart thermostats to getting new grid-connected electric vehicles<sup>xv</sup> and appliances such as heat pumps<sup>xvi</sup>. Economics and policy drivers are accelerating the energy transition faster than many would have imagined (though not fast as some are still calling for) which is accelerating the use of grid resources like wind, solar<sup>xvii</sup>, batteries and others rapidly. In the middle of all this change, operators are trying to keep pace with 20<sup>th</sup> century assets that in many instances are well past their useful lives.

#### Answers to the Electric Grid Crisis

What can we do to increase the capabilities of our grid in the face of such challenging conditions? A great deal, actually. For the last decade, we have helped to promote and accelerate a toolbox of advanced grid applications that are ready to be implemented. We just need to pull out the tools and start using them more widely. I will summarize my remarks in four classes of capabilities: **forecasting, monitoring, planning and deployment**.

##### 1. Advanced Forecasting

Simulation, advanced algorithms, supercomputers, and other technologies are helping us forecast near-future events depending on a variety of factors. For the electric grid, the industry is getting better at forecasting customer demand for electricity — be it an hour, a day, or a week ahead. We are also becoming better at forecasting the electricity *supply* that will be available, based on what impact weather and other factors will have on wind, solar<sup>xviii</sup> and other generation resources. *Keeping customer demand and electricity supply dynamically in balance is the basic equation for reliable power.*

However 'outliner' events that have been considered statistically improbable are becoming more frequent. For example, the heat dome I experienced in Oregon this summer with temperatures in the 115 degree range beat our previous high temperature by eight degrees! With these high impact events increasing in frequency from once in 50 or 100 years to a once in two to five years, we need more sophisticated, higher resolution forecasting to keep the grid in balance.

##### Examples:

- Pacific Northwest National Laboratory (PNNL) and national lab partners have created GridLAB-D™ which is a new power distribution system simulation and analysis tool that provides valuable information to users who design and operate distribution systems, and

to utilities that wish to take advantage of the latest energy technologies. It incorporates the most advanced modeling techniques, with high-performance algorithms to deliver the best in end-use modeling.<sup>xix</sup>

- General Electric (GE) has released grid analytics that combine artificial intelligence (AI) and machine learning (ML) to tackle pressing challenges in electric grid operations. The solutions help transmission and distribution networks maximize operational efficiency with storm readiness, network connectivity and effective inertia.<sup>xx</sup>

## 2. Real-Time Monitoring and Automation

Advanced sensing capabilities allow grid operators to see in near-real-time conditions of the grid that could previously only be determined through costly manual, in-person inspection. Operators can now know the health of assets of the grid including: rotting or damaged poles, abnormal electric currents, trees in contact with or too close to lines, and so on. These solutions include wireless low-cost sensors, geospatial mapping, advanced satellite, thermal and other imaging, drones for seeing hard-to-reach areas, and many other capabilities.

Yet having higher resolution data and acting on it are two very different things. We must move into advanced and automated controls of our electric grid systems so that real-time awareness leads to fast action for enhanced grid reliability.

### Examples:

- New York Power Authority (NYPA) built a digital twin of its operations in New York. This model of transmission and generation assets feeds into asset performance management systems to optimize performance of the grid to assess constraints and grid expectations.<sup>xxi</sup>
- Hawaiian Electric has standardized interconnection processes for its customers and provides maps that show the locational value of distributed resources by circuits attached to their system.<sup>xxii</sup>
- GridWare is start-up company that installs wireless low cost sensors and uses situational awareness to decrease the threat of grid failures that can contribute to wildfire threats.<sup>xxiii</sup>
- The national labs and a California utility are testing a concept that detects falling lines and de-energizes those lines prior to ground contact, acting in just over one second to protect people, property, and forests. The approach relies on real time monitoring equipment that has been at the core of Federal demonstrations.<sup>xxiv</sup>

## 3. Strategic Planning

Detailed engineering plans have guided the evolution of the electric grid since its inception. As a result, the level of service our grid operators provide to communities across the country never ceases to amaze me, given the variables they encounter and the basic physics of electricity.

Today's planning frontier needs to consider such a large number of factors that it must to be approached as a living set of contingencies and adaptive strategies. Unfortunately, many if not most communities, do not have comprehensive resiliency action plans, let alone installed grid flexibility solutions to adapt to circumstances they are already facing. *Grid operators and communities need support to develop broader strategic plans with actionable roadmaps to meet tomorrow's challenges.*

*Examples:*

- Bonneville Power Administration (BPA) has developed and annually updates a wildfire mitigation plan. They had to put it into action this year when fires in Southern Oregon and Northern California took out transmission capacity and this plan helped mitigate the impact of this very disruptive event.<sup>xxv</sup>
- Central Lincoln PUD sits on the Oregon Coast and has created an earthquake and tsunami plan which lays out strategies to prioritize critical investments in the event this catastrophic event occurs.<sup>xxvi</sup>
- Salt River Project (SRP) in Arizona has completed the fourth annual update of its distribution enablement roadmap and is embarking on a year-long process to develop an integrated system plan. This holistic thinking will allow them to integrate gigawatts (GW) of new renewable generation, 100s of megawatts (MW) of distributed resources, and face the many changes they anticipate on their grid from the acceleration of electric vehicles to continued load growth.
- Dozens of manufacturers from Ford to Proterra are introducing vehicles that will allow customers to electrify transportation. Utilities, states, and other stakeholders are beginning to plan for this rapidly nearing transition.<sup>xxvii</sup>
- The North American Energy Resilience Model (NAERM) is a DOE initiative to develop a comprehensive resilience modeling system for North American energy infrastructure, which includes the electric, natural gas, and communications sectors. This model will provide real-time situational awareness and analysis capabilities for emergency events and make it possible to get ahead of emergencies before they happen.<sup>xxviii</sup>

**4. Grid-Enhancing Deployment**

Why aren't there more deployments of grid hardening solutions to help us alleviate the impacts of events we are increasingly seeing? From a technical standpoint, the answer is insufficient activity in the three categories above that lay the foundation. *These areas allow for the better optimization of historic and current data to project conditions in the future.*

But in reality, the much more complex answer includes regulatory and policy pressures. The payback of resiliency investments is often hard to quantify<sup>xxx</sup> and the benefits and impacts fall in realms outside those of agencies with direct responsibility.

The answer also includes other dimensions around the grid itself: changing cultural norms at large organizations; the lagging pipeline of talent in the industry; misaligned incentive structures for desired grid outcomes; complex approval and procurement processes and other factors.

It also includes how these energy assets interact in the market. Many grid resources run on systems that are not at high utilization factors, are in constrained corridors with difficult and expensive build times, or on assets that are nearing or even past their useful lives. Having sufficient access to the transmission system and using that efficiently plays a key role. In the west there are active considerations of the evolution of organized markets. Most entities have joined or are in the process of joining the Western EIM<sup>xxx</sup> and considerations are in place for steps beyond that. Market access played an important role in the polar vortex disaster in ERCOT as well<sup>xxxi</sup>. Markets additionally are complicated -- the Western Interconnection for

example has 38 different balancing authorities.<sup>xxxii</sup> When it comes to resource adequacy many stakeholders across a wide array of geographies hold varying preferences and perspectives. The wider the coordination the stronger the benefits, something the Western Resource Adequacy Program (WRAP) is trying to achieve.<sup>xxxiii</sup>

*Even so, investing in advanced grid deployments is the foundation for making progress for resiliency and working out the broader challenges.*

We have prepared a recent briefing document that illustrates the benefits and impacts from advanced grid deployments ranging from smart grid investments that have brought over \$2 billion of added impacts in one community to single grid hardening projects that have decreased outages by 10% or more.<sup>xxxiv</sup>

It is not easy to articulate the variety of advanced deployment capabilities that help directly address grid resiliency, but a number of them include:

- Advanced controls (fault location, isolation and service restoration (FLISR), integrated core operating systems like outage management systems (OMS) with advanced distribution management systems (ADMS), distributed energy resource management systems (DERMS), expanded supervisory control and data acquisition (SCADA)
- Hardened infrastructure (redundant/looped lines, underground wires, upgraded substations and transformers, higher capacity lines, coatings)
- Modern hardware (smart fuses, faster switches, reclosers, smart inverters)
- Advanced software and grid analytics (including predictive maintenance, machine learning and artificial intelligence)
- Microgrids
- Advanced cyber security capabilities
- Next gen communications networks (including open protocols and interoperability standards)
- Modernized basic maintenance (vegetation management, routine inspections, scheduled upgrades, workflow tracking)

Additional Examples:

- In an LA Times interview last week the CEO of Pacific Gas and Electric Company (PG&E) in California said: "We've also developed a sophisticated algorithm that helps us pinpoint high-risk areas. If we'd had it in place in previous years, we would have prevented 96% of the structures that were damaged or lost due to utility-caused wildfires." The article mentioned the 10,000 miles of transmission and distribution lines the company is planning to place underground over the coming years.<sup>xxxv</sup>
- The National Renewable Energy Laboratory (NREL), in partnership with DOE EERE, has developed a globally unique Advanced Research on Integrated Energy Systems (ARIES) research platform. ARIES is designed to mirror the complexity and scale of real energy systems. Rather than evaluating new clean energy and energy efficiency technologies in silos, ARIES expands the research view to take in the full picture—from consumers to industry to utilities.<sup>xxxvi</sup>
- Our advisor, Steve Parker of EnergySec, shared, "By their nature, the advanced grid functions we seek to deploy present new risks, such as cybersecurity. Just as we would not accept new technology that was unsafe, or that failed frequently and unpredictably, we must not deploy solutions that cannot be operated

securely. Cybersecurity must be seen as an intentional, required design attribute that enables advanced capabilities to be deployed without threatening the reliability and resiliency we seek to enhance.”

- The nearly 100 projects of the Grid Modernization Lab Consortium have demonstrated the vital capabilities that advanced grid solutions in partnership with industry play for the future of our energy systems<sup>xxxvii</sup>
- The Smart Grid Investment Grants from 2009-2013 provided \$3.4 billion in projects that directly brought \$7.9 billion of resources to advanced grid capabilities. Many utilities accelerated their grid modernization plans by as many as 10 years, and other advanced capabilities were accelerated about 5 years in the market place<sup>xxxviii</sup>

**The role of the federal government in accelerating advanced grid capabilities is a critical one.**

- **Leadership:** The national labs play a central role in conducting foundational research and demonstrating early capability of breakthrough solutions as well as partnership with industry in research efforts that bring together various parties with advanced solutions as they scale up
- **Standards:** Coordinated support for standards, permitting, and codes ensures that energy resources meet criteria required for the system and ultimately the strongest benefits for energy customers
- **Coordination:** Programs and projects of federal agencies bring together numerous stakeholders for open discussion and shared efforts to solve complex issues
- **Appropriation:** The Energy Act of 2020 was an excellent piece of legislation to accelerate R&D on many aspects of energy innovation and grid modernization. However nearly all of the authorized aspects of that work (including the entirety of title VIII on Grid modernization) have not been appropriated so they are not doing the industry transformative and accelerating purposes they intend
- **Infrastructure:** The Bipartisan infrastructure act that this wider body passed earlier this year provides nearly \$100 billion in energy and grid related support to further much needed capabilities of the system. Notably the energy title starts off with multiple sections that provide resources to states, utilities and other sector stakeholders for grid resiliency projects and programs. Those \$11 billion in resources are at the top of the list of why we support this package and feel it needs to move as soon as possible. However, the true need for hardening the grid is far more than even what is included in that package. Oregon Senator Wyden has outlined the Disaster Safe Power Grid Act<sup>xxxix</sup> that calls for \$50 billion in grid investments to address wildfire threats alone.
- **Distribution:** I will not get into details of the reconciliation spending package being considered now beyond saying that critical investment in the advanced capabilities of our distribution system is absolutely necessary to accommodate the energy transition already in motion, let alone that may be accelerated by Federal policy actions.

**Summary: Make Resiliency the Hallmark of the 21<sup>st</sup> Century Grid**

Our electric grid is becoming more complex and so are its challenges. With a diverse set of integrated grid assets, flexibility and adaptability of both supply and demand resources become

especially high priorities. This is now increasingly possible because of the capabilities we have walked through in this briefing.

Resilience is no longer a matter simply of energy supply. Instead, we must consider the capabilities of all grid-connected resources, and look beyond simple physical capacity. Central to harnessing these interconnected resources for resilience (and other grid benefits) is access to and participation in wide markets that enable coordination and maximize value. However, technology, markets, policy, or any factors alone will not solve the issue. It will take dedicated coordination at many levels and jurisdictions rowing in the same direction to get the outcomes we really need.

Technology providers, utilities, national labs, and many other stakeholders of the electric grid community have significantly advanced the frontier of capabilities on our grid. We must accelerate the work to get these solutions in widespread use. They include established solutions in commercial adoption such as distribution automation, advanced meters, demand side management, grid storage, and distributed resource optimization. They also include cutting-edge solutions just coming out of labs and into early commercial testing, such as real-time system controls, transactive energy platforms, electric vehicle to grid optimization, and real time monitoring.

We believe the bipartisan infrastructure package passed earlier this year through the Senate and the Energy Act of 2020 together provide an urgently needed down payment to accelerate critical grid infrastructure support and advance much needed resiliency capabilities.

Furthermore, it is critical that Federal resources align with local realities to ensure that our electric grid can remain safe, reliable, and affordable. Looking ahead, we must also prioritize and ensure that our grid is increasingly flexible, efficient, clean, equitable, secure and, as we are talking about today, resilient. If we do, it may be among the greatest achievements of the 21st century following in the footsteps of what the 20th century grid helped us achieve.

Thank you for the time to share these remarks. I am happy to field questions and look forward to the discussion.

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**Written Testimony of N. Levi Esquerro**  
**Before the Government Operations & Border Management**  
**Subcommittee**  
**United States Senate**  
**“Strategies for Improving Critical Energy Infrastructure”**  
**October 27, 2021**

Thank you for this opportunity as I am humbled to be asked to testify at this Senate Homeland Security and Governmental Affairs Subcommittee on Government Operations and Border Management hearing relating to energy resilience and federal permitting. I look forward to sharing my experiences and thoughts regarding the Federal Permitting Reform and Jobs Act. My name is Nathan Levi Esquerro and I grew up on the Colorado River Indian Reservation, near Parker, AZ, and am an enrolled member of the Chemehuevi Indian Tribe. Currently, I am the Senior Vice President of Native American Advancement and Tribal Engagement at the University of Arizona and have been at the University for a little over a year, having spent my professional career working with various Native Nations in Economic and Community Development. During my first interaction with University of Arizona (UArizona) President Robbins, he asked, “how can we work with the 22 Tribes in Arizona?” This may be a simple question, but the answers can be very complex. I answered his question by responding, “When you work with Tribes, you need to have patience, from patience comes respect and after you have respect, trust will shortly follow.” Thus, I wish to share with you how I hope this unique opportunity to reform the Federal Permitting Reform and Jobs Acts will create future economic and community development opportunities for the various Tribal Nations and their communities, but more importantly, create opportunities to build trust.

Prior to coming to the UArizona, I was employed at Northern Arizona University (NAU), overseeing a program that worked exclusively with the 22 Federally Recognized Indian Tribes in Arizona, specifically in Economic and Community Development. About 10 years ago, a new Dean was employed at the College of Business. His name was Craig Van Slyke, and he came from St. Louis. During his first week, I was hosting a group from the Hopi Tribe, and invited Dean Van Slyke to join us in welcoming the tribal community development group. Unfortunately, he couldn’t as he had other commitments and sent the Associated Dean. The Associate Dean came and welcomed everyone and said if you have any questions or concerns, please follow-up with Levi and I. This was typical. After about 5 hours, the meeting was close to concluding when

Dean Van Slyke popped his head in and said, "Great you're still here." He entered the conference room, sat at the conference table and asked if he could introduce himself. The community members and Dean Van Slyke engaged in conversation for about 30 minutes or so. Dean Van Slyke ended the meeting by wishing the community members good luck with their projects and left. This was the beginning of enriching efforts of knowledge and commitment toward tribal entities.

Following the meeting, one of my good friends, Cliff Qotsaquahi invited me to attend his upcoming Hopi village dances. Unfortunately, I had another commitment and could not go, but I asked, "What about the Dean?" He replied, "Do you think he would go?" To that I said, "let me go ask." The Dean indicated it would be a great honor and was excited to go. A few days later, Cliff came to NAU and provided a hand drawn map and instructions regarding some do's and don'ts in attending these dances. After Cliff left, I also stressed the do's and don'ts and added some others as well. A few days later and after the dances, I saw Dean Van Slyke and I asked, "how did everything go?" He gave me a perplexed look and said, "I realize how little I know about the Hopis and other Native Americans. My goal in taking this job is to help students be successful. I define success as not making an "A" or graduating from college, but I define success as reaching your true potential. How can I help the Hopi Students or other Native Americans if I do not know who they are?" Now, I was the one who was looking a little perplexed and he continued. "Levi, I need to go out and meet with the tribes. I need to learn more about them as I want their students and communities to be successful and reach their true potential." Shortly after that, Dean Van Slyke and I started to go out and visit with the various nations. He often called those engagements listening sessions. For we never went with an agenda, but he really wanted to learn more.

The first community we went to visit was the Salt River Pima-Maricopa Indian Community (SRPMIC). We met with, then Vice President and now, current President Martin Harvier. We observed and learned. He asked two questions, with one specifically dealing with financial education. He feared that financial literacy wasn't be taught in the schools or the homes to the levels which were needed. He asked if we could create a tool or mechanism to teach financial literacy. Dean Van Slyke indicated we would do our best and gave me specific instructions to create a financial literacy simulation game. After a year of trial and error, we created Seven Generation Money Management. We have returned often to SRPMIC to share this financial simulation game with their high school youth and with many others. Thus, not only did we listen and learn, but we acted within our capacity. This was a crucial step in building a relationship of trust. To this day, when President Robbins and I meet with Tribes, our agenda is basic and we go to listen and to learn, especially the first initial visit. Based upon those conversations, we develop a plan to address those items we identify and discover, making a point to follow-up with each Tribal Nation to share our progress. I have learned it could take a day to start that journey while with others it could take years. Truly the first step to build trusting is having the patience to listen and learn.

Originally, I was contacted by Anthony Papian and we had a great conversation. It was after we spoke that he invited me to share these experiences and testimony with you.

Upon receiving my undergraduate degree, I went to work for my Tribe (Chemehuevi) and was hired as the Tribal Planner/Grant Writer. This job provided me with endless opportunities, as I could see that Chemehuevi tribe was filled with much potential. I used to look across the lake at night and stare into the lights of Lake Havasu City and was excited to quickly start trying to make things happen. The first thing I did was to automate our Tribe as we were still using typewriters as our main form of documenting and communicating with others. Then the next task was identifying a new water source for our community, which moved on to several other community and economic development projects. However, as I reflect on the success of these projects, I remember two projects that never came to fruition for two different reasons. The first project consisted of our tribe leasing land to *Sea Doo* to open a test site for their watercraft operation. Lake Havasu City hosted the world championships at this time. They wanted to be located in an area we refer to as Ski Cove #1. I worked to bring this project to Chemehuevi and made sure the numbers all worked out and it would be profitable to the Chemehuevi Tribe. I presented the project to my Tribal Council, and after much discussion, the council decided against the project. They liked the project and wanted the project, but it couldn't be located in Ski Cove #1. Ski Cove #1 was the only area within the Tribal Community where the Willow trees grew. Chemehuevis' traditionally use the Willow Tree for a number of items, including our baskets. In that moment, our Tribal Council chose our cultural and traditional and who we are as a people over a project that would make a few dollars and create a handful of jobs. Thus, after that experience, I made up my mind that we needed to reintroduce the Willow Trees in other areas so it could prosper once again within our community. I learned that the Tamarisk Tree had taken over and crowded out many of our native plants and thought the simple solutions would be to eradicate the Tamarisk and reintroduce the Willow Tree and other native plants. However, I learned the Willow Flycatcher, an endangered bird, had taken up residency on the Tamarisk Trees during different seasons. Their populations were decreasing, and we would not be able to eliminate the Tamarisk and the homes of the Willow Flycatcher, as there is a regulation to conserve their habitat under the Endangered Species Act. Consequently, I hit a roadblock of eliminating the Tamarisk trees for a bird that originally lived in the Willow Trees and is named after the Willow Trees..

The second project I want to highlight is a renewable energy project. The Chemehuevi Tribe created the Nuwuvi Economic Development Corporation, whose tasks are to create economic development projects on our reservation. I was the President of the corporation and Council had been contacted by several renewable energy companies. We all thought we were in an ideal site for a solar project. We had the land, we had transmission lines that went through lands, we had sun and very few so-called grey days, and more importantly we had a strong desire. What I thought were assets, I quickly learn that although I could see those transmission lines, we would never be able to provide power to be transmitted to those lines. We learned the Southern

California Edison had no desire to purchase our solar electricity. I learned that complexity of trying to enter into a Purchase Power Agreement and quickly recognized we did not have the capacity to enter into such agreements. I also learned the Bureau of Indian Affairs, who would have to approve our lease at fair market value and would need to increase their capacity to understand the fair market value and future fair market value for this specific renewable energy project. Thus, just having a desire and what I thought assets were not enough. We decided to team up with Acciona, but we could never implement the project. We learned that we would have to get various approvals to gain access to the transmission station, which was roughly 9 miles away from our community. After working with Acciona for a year, they let our partnership terminate as they decided the project, and more importantly the process, would not be worth their return on investment. I realized in that moment that if Acciona walked away from this project, we had some big issues to overcome. Now fast forward 10+ years and that is where we are today.

When it comes to renewables, there have been some successes and one I would like to highlight is the Blue Lake Rancheria in Northern California. In 2017, this Nation launched its low-carbon community microgrid that is assisting the tribe in powering their government offices, economic enterprises, and its critical Red Cross safety-in place facilities. This micro-grid system was established to meet some of the crucial needs within their community. They brought together various resources, laid out their micro-grid goal and then worked to make it happen. I am starting to see more and more collaborations between federal, state agencies and in some cases private partners to develop community and economic development projects within our tribal communities.

In conclusion, I would like to state that I applaud this sub-committee and your work to address the Federal Permitting Reform and Jobs Act. When I was elected Chemehuevi Chairman, I sought out advice from my older brother Ron. He told me that I needed to do three things. First, I needed to do an internal audit. Second, I needed to report back to my citizens on a consistent bases through our newsletter and third, he indicated I needed to work hand in hand with the Bureau of Indian Affairs. I didn't take any issue to the first two items, but the third my response was the opposite and then my brother told me, "Levi, treat them with respect and they will treat you with respect." We tried various things and some of them needed to include the BIA. However, sometimes I was told "No or that is not possible." To that I would respond, "show me in the CFR (Code of Federal Regulations) why we can't." 75% of the time, they could not find the issue in the CFR, and indicated to me that they is just the way they always had done business, but in the remaining 25% of the time they would show me and then we would have a conversation where Agency Director would say, "Levi what are you trying to do and let's see if we can find a way to do it within the regulations." I am forever grateful for my brother's advice and for my relationship with the Allen Anspach (BIA Agency Director) as we worked together on various issues. We built a relationship of trust and for that, my Tribal Community has greatly

benefitted. Thank you for your time, I am humbled to present this testimony and look forward to any questions.

Testimony of Lanny Nickell  
Executive Vice President and Chief Operating Officer  
Southwest Power Pool, Inc.

Before the Subcommittee on Government Operations and Border  
Management of the U.S. Senate Committee on Homeland Security and  
Governmental Affairs

“Strategies for Improving Critical Energy Infrastructure”

Wednesday, October 27, 2021

CHAIR SINEMA, RANKING MEMBER LANKFORD, AND MEMBERS OF THE SUBCOMMITTEE, thank you for the opportunity to participate in this hearing concerning the impact of weather events and other challenges that affect our bulk power system. My name is Lanny Nickell, and I am the Executive Vice President and Chief Operating Officer of Southwest Power Pool, Inc. (SPP) headquartered in Little Rock, Arkansas. SPP is one of seven U.S. Regional Transmission Organizations (RTO) and Independent System Operators (ISO) granted authority by the Federal Energy Regulatory Commission (FERC) to ensure the affordable and reliable delivery of electricity in our 14-state region. As an RTO, SPP's responsibilities include acting as a Reliability Coordinator, Balancing Authority and Market Administrator, roles which are all described in Appendix A of this document. I am testifying before you today regarding our experience managing electric reliability pursuant to these responsibilities during the historic winter weather event of February 2021. I will share with you our organization's observations related to the root causes of the storm's impact on electric reliability and pricing, the lessons we and our member utilities learned from our experiences, and some of the steps we are taking to mitigate and respond more effectively to future grid emergencies.

#### IMPACTS OF WINTER STORM URI ON THE SPP REGION

In February 2021, winter storm Uri had widespread impacts across North America. The states in SPP's region were particularly hard-hit and experienced the coldest temperatures in the nation during the period from February 14-16. Figure 1 below illustrates the overlap between SPP's service territory and the storm's most severe impacts. Many locations across our service territory, from North Dakota to the Texas panhandle, experienced record-low temperatures for days on end. As consumers' use of electricity and natural gas increased in response to the cold, power producers simultaneously faced fuel-supply issues and equipment malfunctions,



transmission system equipment approached unsafe operating limits, and the overall reliability of the bulk electric system was severely tested.

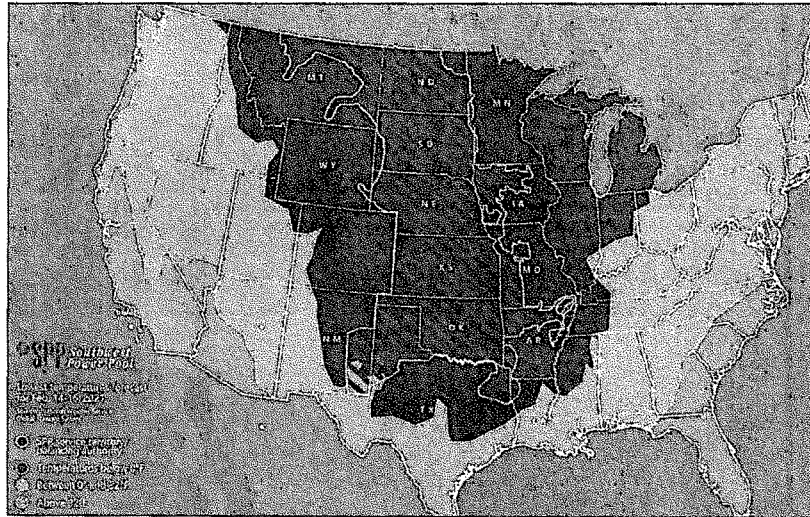


Figure 1: Based on data from the National Weather Service, this map illustrates that the entirety of the SPP service territory was affected by the coldest temperatures in the nation during the period February 14-16, 2021.

Despite the challenges of managing record wintertime electricity use, generation unavailability, fuel-supply issues, transmission congestion and historically high energy costs, SPP kept the lights on across its region throughout the winter storm, with two brief exceptions. SPP directed its transmission operators (TOP) to curtail electricity use by temporarily interrupting their customers' electric service twice: once to lessen regional energy consumption by 1.5% for 50 minutes on February 15 and again to lessen it by 3.25% to 6.5% for a little more than three hours on February 16. Underscoring the historic significance of the February 2021 winter weather

event, these interruptions marked the first times in our organization's 80-year history that SPP has called for region-wide curtailments.

#### SPP'S COMPREHENSIVE REVIEW OF THE WINTER WEATHER EVENT

On March 2, SPP's board of directors directed a comprehensive review of our and our stakeholders' response to the February storm. With input from SPP staff and representatives of our member utilities and state utility commissions throughout our region, the review analyzed operational, financial, communications and other aspects of the events of February 14-20. The review's stated goal was to identify how the organization could learn, adapt and be better prepared for future extreme threats to reliability, and it yielded seven key observations regarding the root causes of the winter storm's impact, SPP's response and its preparedness to respond to future reliability events. Our key observations were:

1. The unavailability of generation, driven mostly by lack of fuel, was the largest contributing factor to the severity of the winter weather event's impacts<sup>1</sup> and was exacerbated by record wintertime energy consumption<sup>2</sup> and an inability to sustain energy imports from neighboring regions<sup>3</sup>. This root cause drives the need to develop policies that improve fuel assurance and resource adequacy (i.e., the degree to which grid operators like SPP can be certain generation will be available to serve demand when it is

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<sup>1</sup> Up to approximately 59,000 megawatts (MW) of nameplate generating capacity in SPP was unavailable to meet demand during the week of the event. When generation was most needed on February 16, about 30,000 MW of generating capacity was unavailable due to forced outages. The largest single cause of these forced generation outages was attributed to fuel-supply issues, causing nearly 47% of the outages and affecting over 13,000 MW of gas generation.

<sup>2</sup> SPP set a new winter peak load of 43,661 MW the morning of February 15 and likely would have reached a wintertime peak of 47,000 MW if not for conservation and curtailments.

<sup>3</sup> Reductions in imports were due to transmission congestion and tightening supply conditions in neighboring areas. Between 2,000 and 2,500 MW of imports were quickly reduced on both February 15 and 16, contributing to SPP's need to shed load each day.

needed). It also highlights the need to further assess how SPP will ensure its ability to reliably operate the grid with continually increasing amounts of intermittent and variable energy resources (i.e., wind and solar resources). Finally, better coordination and communication between the gas and electric industries would facilitate more effective emergency preparation and response activities.

2. Extremely high natural gas prices were the primary driver of record-high wholesale energy offers in SPP's market that exceeded the FERC-required offer cap of \$1,000/megawatt-hour (MWh) for the first time in the market's history. On February 15, SPP's market price reached an all-time high of \$4,274.96/MWh in the day-ahead market. By comparison, the average price of energy in SPP's day-ahead market for the entire year of 2020 was \$17.69/MWh. Natural gas markets are not subject to price or offer caps, while electricity markets like SPP's are. Gas industry policies should assure supply and transportation are reliably and affordably available to enable the operation of generating assets during extreme events.
3. The rapid spike in SPP's market prices resulted in an immediate concern about liquidity of market participants and created an exponential increase in short-term credit exposure.<sup>4</sup> This issue demonstrates a need to improve our credit policies invoked during extreme pricing conditions and to clarify SPP's tariff requirements regarding credit-related authorities and responsibilities.
4. Relationships and interconnections with neighboring systems were critical. Usually a net exporter of energy, SPP relied significantly on imported energy to serve load during

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<sup>4</sup> SPP sought and received a waiver from FERC extending the cure period for load serving entities to satisfy calls for financial security.

much of the winter event, with net amounts exceeding 6,000 megawatts (MW) at times. This emphasizes the value these relationships and robust transmission interconnections provide during emergency events. SPP had to curtail electricity usage when transmission constraints on neighboring systems forced reductions in energy imports, which demonstrates the need and opportunity to strengthen those interconnections.

5. The SPP transmission system was highly congested at times during the event with limitations that prevented full use of generation available in certain locations.<sup>5</sup> This issue contributed to SPP's need to curtail electricity usage through use of its established load-shed procedures and raised questions about the appropriateness of regionally allocating load-shed responsibilities when transmission constraints are being observed.
6. Early preparation, timely decisions and effective communication and coordination with SPP utilities and neighboring systems helped minimize the winter storm's impact on reliability.<sup>6</sup> Early communication of a public appeal for conservation contributed to reduced demand on February 15, reducing the amount of controlled service interruptions required. Effective communication of and prompt response to load-shed instructions likewise mitigated the risk of uncontrolled cascading blackouts.
7. SPP's stakeholders indicated general satisfaction with SPP's emergency communications, information sharing and credibility related to the winter storm response, although some

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<sup>5</sup> SPP experienced 54 transmission constraints at the time load shedding began February 16 that resulted in nearly 1,900 MW of generation being reduced to maintain reliable energy flows on those facilities.

<sup>6</sup> FERC and the North American Electric Reliability Corporation's September 23, 2021 preliminary findings of the grid operations during the February 2021 winter weather event found that SPP and the other Reliability Coordinators "coordinated and communicated well with each other."

areas of improvement were identified, particularly in those related to end-use customer awareness.

As part of our review, SPP staff and stakeholders evaluated hundreds of potential process changes, system enhancements, new and amended policies, further assessments, and other potential solutions meant either to address the root causes of the February 2021 event's impact on the SPP system or to better enable SPP and its stakeholders to respond to future extreme system events. Ultimately, we arrived at a group of 22 actions, policy changes and further assessments related to improved fuel assurance, resource planning and availability, emergency response, market design, operator tools, transmission planning, credit practices, and communications. Work is now underway to implement each of these recommended improvements, and SPP staff will provide status reports to our board of directors at public, quarterly meetings.

#### FUEL ASSURANCE

As noted above, the electric industry is dependent on our nation's gas pipeline system to transport and supply natural gas. In February, the extreme cold that affected our region led to natural gas procurement and deliverability issues. Generator operators lacked access to natural gas because of both gas production issues attributed to wellhead freeze-offs and an increase in consumer demand for natural gas to heat homes. It is important to note that the electric industry does not have the ability, nor should it have the responsibility, to ensure a reliable, resilient and affordable natural gas supply. It is incumbent upon the natural gas industry to make the changes necessary to improve reliable, affordable supply and transportation of natural gas during extreme weather events. It is imperative that regulators and legislators understand the limitations of the electric industry in improving natural gas supply and transportation. Any new requirements to

improve natural gas supply and transportation need to be imposed upon the gas industry and not the electric industry if this situation is to be improved.

SPP has made several improvements related to gas-electric coordination in the past five years. In 2015, FERC issued Order No. 809, "Coordination of the Scheduling Processes of Interstate Natural Gas Pipelines and Public Utilities." In response to the order, in October 2016, SPP shortened its day-ahead market timeline and shifted its closing and posting times to better align with standard gas industry procedures. In May 2020, SPP reduced its day-ahead market timeline by another hour. And between 2016 and 2018, SPP coordinated with market participants to increase awareness of the need for additional detail in outage reporting, particularly fuel issues. SPP recently implemented a multiday commitment and pricing forecast, which should provide generation-owning market participants with additional information related to generation needs. SPP continues to seek opportunities for gaining efficiencies that better align the day-ahead market with the gas day. Since the February winter weather event, we have also welcomed our first gas-production company, Continental Resources, as a member of our RTO, and will welcome our first gas pipeline company, Southern Star, as a member before the end of the year. These partnerships represent new opportunities for the electric and gas industries to more closely collaborate in the interest of reliability and economics than we have historically.

#### RESOURCE PLANNING AND AVAILABILITY

The 2021 winter weather event also highlighted weaknesses of the components of the supply-side of the grid. Every type of generation (e.g., natural gas, coal, wind, etc.) experienced stress and outages to some degree. The event struck during a time of tremendous change in the nature of energy and capacity being planned and supplied in our region. These changes will continue, and considered alongside generator performance issues observed during this winter's event, this

underscores the need to further assess SPP's ability to reliably operate the system with the increased use of intermittent resources and further reduction of base-load resources. As our resource mix is expected to continue to evolve, the way resource adequacy has been determined in the past does not appear adequate to meet the needs of the future.

#### TRANSMISSION PLANNING

The electric utility industry depends on adequate transmission infrastructure to deliver power. Transmission will also play a critical role in mitigating the impact of future extreme weather events, as it can enhance resilience and could mitigate the need to implement load-shed procedures. Although severe congestion was experienced at times during the 2021 winter weather event, investments of approximately \$10 billion over the last 15 years to upgrade the SPP transmission system allowed SPP to more fully utilize available generating resources. SPP also relied on the transmission network that extends outside its own region to import significant amounts of energy from its neighbors. Electric transmission infrastructure, both within and outside SPP, proved critical and beneficial in avoiding longer controlled interruptions of service.

In assessing future transmission needs, our industry must increasingly consider the potential impacts of severe events and the value additional transmission infrastructure can add by providing increased resilience. This is why we continuously look for ways to improve transmission planning study processes that evaluate the amount of transmission capacity needed during normal and emergency conditions.

#### CONCLUSIONS

SPP's staff and stakeholders have characterized the events of February 14-20 as the most operationally challenging week we have faced in our organization's 80-year history. We are

proud of how we worked together to minimize the impacts of this storm to the nearly 18 million people who live in the SPP region. We are indebted to our partners in responding to this event: member utilities, neighboring systems, and millions of people who voluntarily made sacrifices to conserve energy in the interest of the greater good. Our decisions on February 15 and 16 to curtail power, in accordance with North American Electric Reliability Corporation (NERC) standards, were made as last resorts and marked the first time SPP has ever had to direct controlled interruptions of service to our entire region. We did so only after exhausting every other option, including bringing emergency generation online and importing power from neighboring regions and in response to ever-changing system conditions that can quickly deteriorate in an instant without appropriate intervention. We understand the critical role reliable electricity plays in peoples' everyday lives, and that to go without it, especially in a prolonged period of extreme cold, puts lives and livelihoods at risk. After months of review and analysis, we stand by our decisions, because the alternative would have been far worse, and had we not deliberately lessened our regional electricity use, we could have faced cascading outages that were longer, more widespread, and more costly in terms of both lives and economics.

Many of the factors that contributed to the severity of the February storm's impacts were externalities that SPP could not control: low temperatures, the duration of the storm, fuel supply issues and prices set by gas providers, for instance. Similarly, SPP and its stakeholders will almost inevitably face other crises that arise from circumstances they cannot prevent, whether they result from natural disasters, mechanical failures or acts of terrorism. These conclusions and the findings of our comprehensive review all suggest that while SPP and its members performed well, there is room for improvement in our organization, region and industry. SPP is now shifting from a posture of retrospective analysis of the February event to one of preparation for our next



challenges. Nearly 100 unique initiatives are now underway to implement the recommendations that our comprehensive review produced. We encourage others in our industry to follow suit, applaud those who've already done so, and commit to working together to ensure we are all equipped to effectively manage future crises.

#### APPENDIX A: SPP'S ROLES IN ASSURING ELECTRIC RELIABILITY

SPP serves in a number of capacities related to the coordination of the regional power grid. Those most relevant to the February 2021 winter weather event are its roles as a regional transmission organization (RTO), reliability coordinator, balancing authority and market administrator.

**SPP AS AN RTO:** As an RTO, SPP is granted specific responsibilities by the Federal Energy Regulatory Commission (FERC). Rates, terms and conditions by which SPP oversees the regional power grid and coordinates with its member utilities are defined in a FERC-approved tariff. 106 member utilities in 14 states are members of the SPP RTO, meaning they have placed their power plants and extra high-voltage transmission facilities under SPP's functional control. RTO membership is voluntary, though the member roster has steadily grown since SPP became an RTO in 2004 because of the value the organization provides: enhanced reliability and cost savings as compared to the status quo of utilities operating on their own.

**SPP AS A RELIABILITY COORDINATOR:** As a reliability coordinator (RC), SPP functions like an air traffic controller for electricity. Air traffic controllers do not own skies, planes or airports they coordinate. Similarly, SPP does not own power plants, transmission lines or electricity, but it directs these and other components of the bulk power system to ensure electricity is delivered safely and affordably from where it is generated to where it is used in real time. RC activities are governed by the North American Electric Reliability Corporation (NERC), who enforces standards related to the reliable operation of the country's bulk electric system. (For more information on the standards most relevant to the winter event, see the Applicable Standards and Regulations section.)

SPP staffs a 24/7 control room and backup facility from which it maintains constant communication with member utilities. RC staff constantly plan for contingencies and operate from an N-minus-one posture, meaning they work to keep the grid ready to respond to the next worst contingency such as the loss of our largest generating unit. SPP keeps operating reserves online equivalent to one-and-a-half times its region's largest generating unit. This means it keeps enough generation online to meet real-time demand and enough "spinning" and ready to flow onto the grid immediately if committed generation becomes unavailable.

**SPP AS A BALANCING AUTHORITY:** The nation's power grid comprises three interconnections: Eastern, Western and the Electric Reliability Council of Texas (ERCOT). Each is a single massive, highly interconnected network of generators, transmission lines and substations that feed power to local distribution networks that serve homes and businesses. Disturbances anywhere on one of these networks are felt across the entire interconnection. The SPP RTO is part of the Eastern Interconnection.

As a balancing authority (BA), SPP keeps real-time production and consumption of electricity in balance. It does this for its entire 14-state balancing authority area. Other entities serve as the BAs in other regions, big and small, across the country. Production and consumption of electricity must be kept nearly perfectly in balance to prevent equipment failures and the potential for large-scale, cascading outages. In the absence of utility-scale energy storage devices like batteries, electricity is produced, transported, delivered and consumed nearly simultaneously. Damage to the grid can occur if either more or less energy is produced than is needed at that time. SPP forecasts demand (also called load) in five-minute increments, and sends signals every four seconds to more than 800 generators in its BA area to ensure they are

collectively producing just enough power to meet demand without overloading lines or damaging equipment.

**SPP AS A MARKET ADMINISTRATOR:** SPP facilitates a wholesale electricity market that automates selection of the cheapest available energy to serve load minute-by-minute. SPP's market is fuel-agnostic, meaning it does not favor any particular fuel type over another but treats coal the same as wind, natural gas the same as nuclear power, etc. The market only takes into account the price at which generators offer energy into the market, and it picks the least-cost power available to meet demand, taking into account operating characteristics such as lead times (the amount of time it takes a generator to spin up from inactivity), minimum run-times, etc.

SPP's is a day-ahead market, meaning it commits generation a day in advance. As the region nears real-time, intraday market processes make additional commitments every five minutes to ensure the right amount of generation is online as weather patterns, electricity use and other factors vary from forecasts.

Like its tariff, SPP's market design is approved by FERC, and its administration is overseen by an independent market monitor that watches to ensure the market operates fairly and without undue influence by any single participant or group of like-minded participants. SPP is a not-for-profit organization, registered as a 501(c)(6) in the state of Arkansas. As a market administrator, it facilitates the sale and purchase of power through its market, and SPP administers the process by which those transactions are invoiced and settled, but it does not profit from these activities. SPP is completely funded by a FERC-approved administrative fee assessed to our members and market participants based on their use of our services.

In summary, SPP is authorized and regulated by FERC to carry out certain responsibilities related to the reliable operation of the regional power grid. It is required to comply with enforceable NERC standards, and its staff works around the clock every day to ensure energy production and consumption are held in balance while planning against contingencies that could threaten reliability. SPP's market helps do this by committing the least-cost generation that is available to serve load.

**Written Testimony of Robert Bryce  
Author, journalist, film producer, and host of the Power Hungry  
Podcast  
Before the Government Operations & Border Management  
Subcommittee  
United States Senate  
“Strategies for Improving Critical Energy Infrastructure”  
October 27, 2021**

Good afternoon.

America’s electric grid is our most critical piece of energy infrastructure.

The electric grid is the Mother Network, the network upon which all of our critical systems depend. Our hospitals, nursing homes, pharmacies, police stations, fire stations, traffic lights, water, wastewater treatment, Internet, cell phones, and other essential services – all depend on the electric grid.

But the affordability, reliability, and resilience of our electric grid are being undermined. Over the past few years, the fragility of our grid – and its vulnerability to cyberattacks, physical attacks, and extreme weather events – has become ever more obvious.

Despite the grid’s growing fragility, climate change activists and policymakers are pushing for dramatic increases in the use of wind and solar energy. They are also pushing efforts to “electrify everything.” These efforts include bans on the use of natural gas for heating and electricity generation and bans on the sale of automobiles and equipment with internal combustion engines. This would force consumers to rely solely on electric vehicles and battery-powered outdoor equipment.

These policies are not just wrongheaded, they are deeply dangerous. Banning the use of liquid and gaseous fuels will reduce America’s energy security because it

will concentrate our energy risks on a single energy network, the electric grid. Furthermore, they would require an electric grid with more than two times the capacity of today's grid. That's a largely fanciful notion given that the electric grid is faltering under existing demand.

My remarks will focus on the decline in the grid's reliability, the policies that are undermining the integrity of the grid, and what policymakers should be doing to assure our energy grids are resilient and able to deliver affordable and reliable energy and power to American consumers 24/7/365.

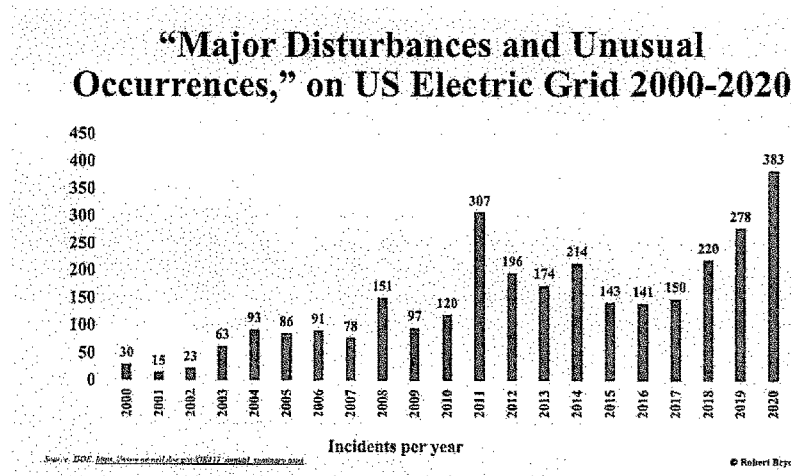
#### **Declining grid reliability**

There is no doubt that our electric grid is becoming less reliable. Earlier this week, the *Washington Post* reported that in 2020, "the average American home endured more than eight hours without power, according to the U.S. Energy Information Administration – more than double the outage time five years ago."

In California, over the past two or three years, blackouts have become almost daily events. In Texas, the country's biggest producer of oil, gas, and wind energy, the February blackouts caused by Winter Storm Uri cost some \$200 billion and left about 700 people dead.

According to data from the Department of Energy, between 2000 and 2020, the number of what the agency calls "major electric disturbances and unusual occurrences" on our electric grid jumped 13-fold. The upward trend in these occurrences can easily be seen in Figure 1.

Figure 1



Consumers and businesses have responded to the decline in electric reliability by rushing to install backup generators. As I explained in an article I published in the *Wall Street Journal* on September 7, sales of standby generators are soaring. I wrote that Generac Power Systems, which specializes in home generators “announced in July record sales of \$920 million during the second quarter, a 68% jump over last year. But what’s good for Generac is bad for America. That’s no slam on the Wisconsin-based company, which manufactures about three-quarters of the home standby generators sold in the U.S. Instead, Generac’s soaring sales are evidence that the U.S. electric grid is becoming less reliable, which will make Americans less wealthy and less secure.” In a recent investor presentation, Generac said that power outage severity is “increasing significantly.”

Sales and installations of standby generators are particularly strong in California, a state that has seen a steady decline in the affordability and reliability of its electric grid. On October 6, M.Cubed, an economic and public policy consulting group, released a study which found that “Over the last year, the generator population jumped by 22 percent in the South Coast Air Quality Management District, and by 34 percent in the Bay Area Air Quality Management District over the last three years. In 2021, the two districts were collectively home to 23,507 backup



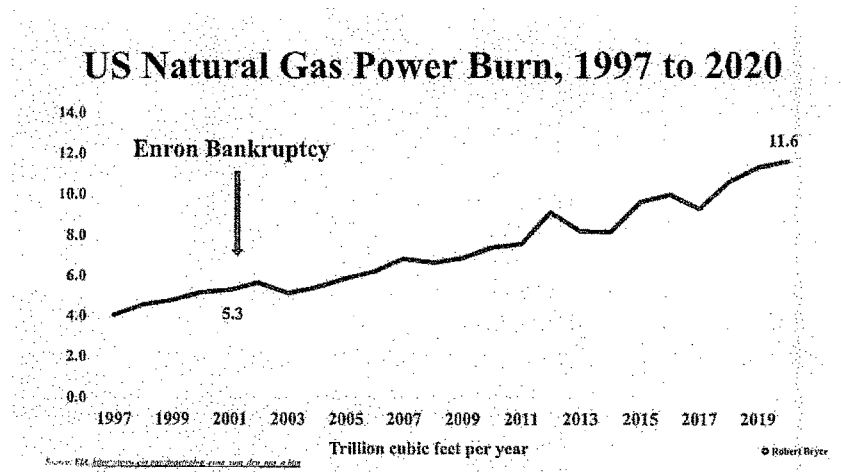
generators with a capacity of 12.2 gigawatts (GW), about 15 percent of California's entire electricity grid. Of these, 20,907 are diesel-fueled."

**Factors undermining the grid**

Several interrelated factors are making our grid more fragile. The first and most important factor is the shift in the energy sources being used for electricity generation. Over the past two decades, due to state-level mandates and lavish federal subsidies, the domestic electric grid has become far more reliant on weather-dependent and intermittent renewables like wind and solar. Over that same time period, dozens of coal and nuclear plants -- which provide resilient baseload power and help keep the grid stable, have been prematurely shuttered because they cannot compete with subsidized wind and solar energy.

According to the Energy Information Administration, in 2020, coal-fired generation in the U.S. was about one-third of what it was in 2005. The EIA also notes that coal-fired generation now provides less energy to the grid than natural gas or nuclear. In March, the EIA reported, "U.S. coal-fired electricity generated totaled 774 million megawatt-hours (MWh) in 2020, which is less than both natural gas-fired (1.6 billion MWh) and nuclear-powered generation (790 million MWh). Indeed, as shown in Figure 2, since 2001, when Enron went bankrupt, the amount of natural gas consumed by the U.S. electric sector has more than doubled.

Figure 2



While natural gas produces about half as much carbon dioxide during combustion as coal, it is a “just-in-time” fuel, meaning it is delivered by pipeline at the time it is needed. Gas-fired generation plants are less reliable than plants that have on-site fuel storage, meaning plants that rely on coal, uranium, or petroleum.

The just-in-time delivery of natural gas to power plants is not a problem when demand for electricity and heating is low. But as was made clear during the February blackouts in Texas, the overreliance on natural gas can have devastating consequences. Furthermore, despite the interrelated nature of the electric grid and the natural gas grid, regulators do not orchestrate their operation to assure that they are singing from the same hymnal. During the February blackouts, some gas infrastructure in Texas froze. Some gas processing plants and pipelines had their electricity cut off. That, in turn, reduced the amount of fuel available to produce power when electricity was needed the most.

A few months after the 2011 winter storm that caused blackouts in Texas, the Federal Energy Regulatory Commission and the North American Electric Reliability Corporation issued a report which warned about the “interdependency of the electric and natural gas industries” and urged “regulatory and industry bodies to explore solutions to the many interdependency problems which are likely

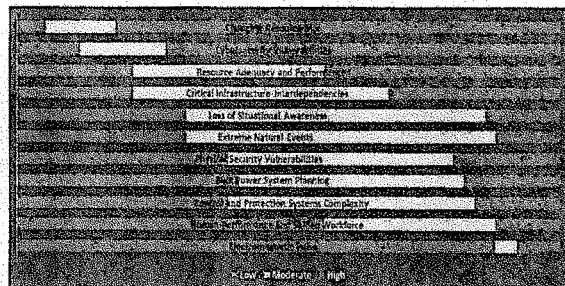
to remain of concern in the future.” But Texas and other states have not taken substantive measures to reduce the electric grid’s reliance on natural gas.

The electric grid’s overreliance on natural gas is occurring at the same time our grid is becoming more reliant on intermittent wind and solar energy. As I discussed above, the Department of Energy’s own data shows the increasing frequency of grid disturbances. This data should be a wake-up call for Congress to the very real possibility that the United States could be hit by a wide-area, long-term blackout if we do not take action to ensure the resilience of our grid.

Of course, renewable-energy promoters, as well as large environmental groups like the Rocky Mountain Institute, Sierra Club, Natural Resources Defense Council, Environmental Defense Fund, and others, don’t want to admit that wind and solar are undermining our grid and placing lives at risk. But on August 13, the North American Electric Reliability Corporation, issued a report which identified “changing resource mix” as the most urgent challenge facing the reliability of the U.S. electric grid. It also said America’s electric generation capacity “is increasingly characterized as one that is sensitive to extreme, widespread, and long duration temperatures as well as wind and solar droughts.”

Figure 3

### NERC “ERO Reliability Risk Priorities Report,” August 12, 2021:



America’s electric generation capacity “is increasingly characterized as one that is sensitive to extreme, widespread, and long duration temperatures as well as wind and solar droughts.”

Source: [https://www.nerc.com/~/media/NERC/Documents/ERO%20ReliabilityRiskReport\\_Final\\_ERO\\_August12\\_2021\\_Remed\\_SelfSigned\\_Tier1.pdf](https://www.nerc.com/~/media/NERC/Documents/ERO%20ReliabilityRiskReport_Final_ERO_August12_2021_Remed_SelfSigned_Tier1.pdf)

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The danger of such droughts can be seen by looking at the ongoing energy crisis in Europe, which was caused, in part, by extended periods of calm winds. As the *Wall Street Journal* reported on September 13, a drop in wind in the North Sea “whipsawed through regional energy markets.” Gas and coal-fired electricity plants were called in to make up the shortfall from wind.” It continued, “To be sure, abundant wind power has at times led to periods of cheap electricity. This month, however, U.K. wind farms produced less than one gigawatt on certain days...Full capacity stands at 24 gigawatts.”

Prominent executives in the utility sector have also said that renewables can be bad for reliability. On March 10, in testimony in front of the Senate Environment and Public Works, at a hearing captioned “Building Back Better: Addressing Climate Change in the Electricity Sector and Fostering Economic Growth,” Xcel Energy CEO Ben Fowke said, “At higher levels of intermittent renewables, the cost of the energy system begins to skyrocket and its reliability degrades.” (Fowke retired from Xcel in August.)

Generac, which profits by manufacturing standby generators, has also pointed to the increased use of renewables as a reason for the fragilization of the grid. The company’s investor presentation says key reasons for declining reliability are an “aging and under-invested electrical grid” and “increasing use of renewables leading to variability of supply and grid instability.”

Finally, it is clear that the country’s bulk power system is being mismanaged by regional transmission organizations like ERCOT in Texas and CAISO in California. Those entities manage the flow of power within their jurisdictions, but they are not providing enough incentives to assure the reliability and resilience of the electric grid. In recent years, CAISO has presided over frequent power shut-offs that affect thousands, and sometimes, millions of consumers. The mismanagement of the California grid also presents a risk to grids in adjacent states that are electrically interconnected.

#### **Assuring resilience and reliability**

Congress should take several steps to assure the resilience and reliability of the grid. First, it should do whatever it can to prevent the closure of any more coal and nuclear plants before policymakers and regulators can prove that their closure will not reduce the reliability and resilience of the grid. In particular, federal lawmakers should accelerate the development and rapid commercial deployment of reactors that are smaller, faster, cheaper, and safer than the fleet of reactors now in use.

Those reactors which are often referred to as small modular reactors, or SMRs, will be able to provide stable, dispatchable, zero-carbon power to the grid.

I have written about this many times, but I will say again that the premature closure of New York's Indian Point Energy Center – a closure that was cheered by some of America's biggest environmental groups – was a travesty. That plant, by itself, provided about 25% of the electricity used by New York City. The closure of Indian Point will make the New York grid more reliant on natural gas and renewable energy, which as discussed above, will make the state's grid less reliable and less resilient. The closure also resulted in a spike in carbon dioxide emissions in New York due to the increased use of natural gas.

Second, the lavish federal tax incentives for wind and solar energy production – the production tax credit (PTC) and the investment tax credit (ITC) – should be eliminated immediately. Those subsidies distort wholesale power markets and make the grid more reliant on weather conditions, including prolonged wind and solar droughts.

In addition to reducing the reliability of the grid, wind and solar are also costing taxpayers billions of dollars per year. As I noted in a report I wrote earlier this year for the Center of the American Experiment, between 2010 and 2029, those tax credits will cost the federal treasury about \$140 billion. Designed to stimulate nascent industries, the PTC and ITC have become blatant examples of the crony corporatism that is undermining the integrity of the electric grid. The PTC and the ITC reward weather-dependent intermittent generation at the cost of dispatchable generation.

In 2015, Congress agreed on a five-year phase-out of the PTC. After that deal was struck, Sen. Charles Grassley, the Iowa Republican, and alleged deficit hawk said "As the father of the first wind-energy tax credit in 1992, I can say that the tax credit was never meant to be permanent." But the PTC keeps getting extended, including yet another extension granted in June by the Internal Revenue Service. For years, Big Wind and Big Solar have claimed that they can produce the cheapest electricity. It's time for them to prove it.

Third, Congress, along with federal regulators must look for ways to incentivize electricity generators to have on-site fuel storage at their power plants. One of the key lessons that emerged from the February disaster in Texas was that the most reliable power plants were the ones that had on-site fuel, that is, the coal and nuclear plants. But those federal incentives don't have to be limited to nuclear or

coal. Fuel oil can be stored easily and relatively cheaply. It could be used in quick-start combustion turbines or in large reciprocating engines that could be deployed to help assure the resilience of the electric grid.

### Conclusion

Over the past decade or so, I have testified before Congress four times. In my appearances before Congress, and in the books and articles I have published over the past decade, my message has been consistent: for energy security, and for climate concerns, we need nuclear energy and lots of it. In 2019, in testimony before the Senate Energy and Natural Resources Committee, I said, “If the US wants to foster the innovation needed to sustain growth in nuclear-energy technology, Republicans and Democrats will have to forge significant, long-term commitments toward that goal.”

Today, I am reiterating that same point. If we want a resilient and reliable grid, we cannot rely on a system whose performance and reliability depend on the weather. We need stout power systems fueled by generators that don’t depend on the vagaries of the wind or the sun.

The caption for this hearing is “Strategies for Improving Critical Energy Infrastructure.” For too long, policymakers have ignored the fragility of the electric grid. They can ignore it no longer. The data from the Department of Energy on the increasing numbers of blackouts, along with the soaring sales of standby generators, are evidence that our grid is being undermined by the senseless, headlong rush to add renewables while retiring baseload power.

Furthermore, Congress must recognize that we cannot treat electricity as though it is a commodity like crude oil, sneakers, or pork bellies. Electricity is a critical service that is delivered by a complex network that cannot be allowed to fail.

Congress must act, and act with all deliberate speed, to assure that the electricity that powers our economy stays affordable and that our grid is reliable and resilient. If a cyberattack, physical attack, solar storm, or other wide-area event causes a cascading collapse of one of the three U.S. grid interconnections, prompt recovery may not be possible if “black start” generators do not have sufficient on-site fuel supplies. A May 27 article in the *Wall Street Journal*, “The Texas Grid Came Close to an Even Bigger Disaster During February Freeze,” revealed that nine out of the 13 primary black start generators in the state malfunctioned during the crisis, with at least two units being shut down for lack of fuel. According to testimony by ERCOT CEO Bill Magness, the Texas grid was less than five minutes away from

total collapse. Restoring the ERCOT grid after the collapse would have taken weeks or even months. Had that occurred, the losses in economic and human terms would have been horrendous.

In summary, the electric grid is our biggest, most complex, and most important piece of energy infrastructure. We take it for granted at our extreme peril. Essayist Emmet Penney had it right when he declared earlier this year that “there is no such thing as a wealthy society with a weak electrical grid.”

America cannot afford to have a weak electric grid.

Thank you.

**END**



## Advanced Grid Projects Benefit Citizens, Businesses and the Nation as a Whole

As our country grapples with the realities of the continued pandemic, climate change impacts, societal pressures, a fragile economy and other pressing issues, an important common thread is the need for reliable, affordable power. Our electric grid is a vital resource for maintaining supply chains, rescue services, community investment and meeting national goals.

**Yet underinvestment in the grid looms as the U.S. is facing a \$208 billion (in 2019 dollars) grid investment shortfall by 2029, causing direct threats way of life and our future prosperity.<sup>1</sup>**

The benefits from investment in the grid are undeniable and industry actors have been busy deploying advanced grid applications and demonstrating the value they bring. Grid Forward has collected a wide range of examples from our community and partners.

### Improving Grid Resiliency to Decrease Outages

-  A **New York** utility deployed monitoring and controlling capabilities for distributed assets that helped decrease customer outages by 10%.
- A **Washington** State utility is deploying a community microgrid that will power community assets for 22 hours in islanded mode and have about 1/3 capability when solar resources are available.
-  A remote **Alaska** community has ungrounded its transmission and distribution power lines, has a battery functioning as a grid resource and has nearly eliminated all outages and reduced diesel use by about 70,000 gallons annually.
- A **Montana** utility is deploying a microgrid to provide rural customers power in the case of an outage, the solution also provides grid support under normal conditions and is a test for implementing further projects.
-  An **Arizona** utility has partnered with military facilities to reduce single grid points of failure and ensure critical load continuity with enhanced grid infrastructure.
- A **Washington** State utility is deploying advanced analytics and machine learning for vegetation management and wildfire risks anticipated to reduce customer outages up to 10%.
-  A **California** utility has deployed 13,000+ fast acting fuses, 1100+ weather stations, 160+ cameras, along with 150,000 annual tree assessments with other advanced control solutions in high risk areas to mitigate wildfire threats.



**Eliminating outages in a remote Alaska town.**

#### Key:

 Received Federal funding

<sup>1</sup> <https://infrastructurereportcard.org/the-impact/failure-to-act-report/>





### Faster Response After Extreme Weather Events

- A **Texas** grid operator avoided an estimated 45 million outage minutes in storm recovery after a single event with advanced grid solutions.
- Using advanced grid capabilities, a **Florida** utility restored power to more than two million customers in less than a day after a major storm.
  - To improve event management and lower outages, a **Southwest** utility is deploying a resiliency management system in its control center to process, integrate, prioritize, and understand data better.
- An **Oregon** utility leveraged its demand side capabilities, distributed resources, market access and other advanced capabilities to minimize customer impact during a record breaking heat event.
- Automation on a **Washington** State utility grid restored power during a storm to 860 residents in 40 seconds, which previously would have taken at least 12 hours.



**45 million**  
customer outage  
minutes avoided.

*Investing in the grid now  
saves lives, properties,  
and communities  
and creates jobs and  
stability. We must pass  
the Infrastructure and  
Reconciliation Packages  
and get to work.*

### Optimized Operations to Ensure Affordable Service for All

- An **Ohio** utility integrated data from advanced metering into a real-time optimization platform, which increased energy savings from 3% to 4%, all without requiring customers to take any action.
- At one **Illinois** utility, smart grid programs have created \$1.4 billion in societal benefits, saved customers \$2.3 billion, and reduced outages 44%.
- An eastern **Canadian** utility is using machine learning and weather, environmental and other data in an advanced model that is 7x more effective than previous processes at selecting the assets for priority replacement.
- A **California** utility added automation on 17% more of its substations that reduced customer outage time by 37%.
- An **Oregon** utility has 67% of all customers in 3 separate communities participating with flexible loads to serve the grid in greatest times of need.
- An **Idaho** utility has saved \$120M from its advanced metering deployment.



**\$2.3 billion** in  
customer savings.

### Improving Energy Equity to Lift Up Underserved Communities

- A **Nevada** utility deployed distribution automation (which quickly identifies equipment or system issues) across its territory saving \$1.75 million each year that helps keep customer rates down.
- A **Washington** State utility is supporting transportation electrification, including mass transit, and expanded options to vulnerable communities.
- A small utility in **Montana** has deployed updated customer portals to offer individuals near real time data and assist in making better energy related decisions.
- A small, rural **Alaska** community has developed solar and storage resources that allowed diesel generators to stop running and provide educational opportunities.<sup>2</sup>



**Transportation  
electrification**  
to serve vulnerable  
communities.

1. Sources for all examples  
can be found at [https://  
gridforward.org/resources/  
grid-modernization-impacts/](https://gridforward.org/resources/grid-modernization-impacts/)



## ARRA grid modernization funds delivered diverse benefits

The 2009 American Recovery and Reinvestment Act included provisions for the electrical energy sector that shortened key electric grid modernization milestones, achieving many five years earlier and accelerating grid operator priorities by up to ten years. Numerous project benefits included:

- Improved distribution system reliability by up to **50%**
- Reduced peak load of more than **30%**
- Reduced operational costs of up to **50%**
- Improved efficiency of distribution systems by almost **3%**

## Making Critical Investment in the U.S. Electric Grid Now

The last 12 months made clear the central importance of a robust energy system across our country. During an unprecedented global pandemic, major and often unprecedented weather events lay bare how grid modernization is far behind schedule, and is becoming more important than ever before.

- **Winter storms** in the Northwest and Southeast caused widespread outages during frigid weather, costing billions in damages and a loss of hundreds of lives.
- **Heat events** in the Western U.S. caused hundreds of avoidable deaths and unprecedented need for air conditioning and energy demand.
- **Wildfires** in the U.S. West disrupted transmission lines, destroyed communities and displaced thousands—once again costing billions in damages and loss of many lives.
- A pipeline **cyber-attack** disrupted economies and daily lives across the East coast.
- **Storms** in Gulf States that tracked into the Northeast cost many lives, destroyed infrastructure—and will only get more devastating.

## Grid Modernization is More Important Than Ever Before

A robust portfolio of advanced grid solutions is ready and able to meet the need. We must increase the capabilities on our grid to ensure our grid is:

- **Resilient** in the face of climate change and other disasters
- **Flexible** to meet changing consumer needs and government regulations
- **Secure** against natural and man-made threats
- **Decarbonized** to meet societal goals and future livability
- **Equitable** to all aspects of society

» [https://www.energy.gov/sites/default/files/2015/10/f27/0E%20ARRA%20Grid%20Modernization%20Highlights%20October2015\\_0.pdf](https://www.energy.gov/sites/default/files/2015/10/f27/0E%20ARRA%20Grid%20Modernization%20Highlights%20October2015_0.pdf)

Grid Forward is an industry association promoting and accelerating grid modernization across the U.S. west via advanced technology, policy progress and business innovation.

Need more information? Contact [Bryce Yonker](#), Executive Director, Grid Forward or visit [GridForward.org](http://GridForward.org).

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**Post-Hearing Questions for the Record**  
**Submitted to Alex Herrgott, President & Chief Executive Officer, The Permitting Institute**  
**From Senator Kyrsten Sinema**

**“Strategies for Improving Critical Energy Infrastructure”**  
**Wednesday, October 27, 2021**

1. According the US Energy Information Administration, decarbonized sources of electricity made up 20 percent of all power generated in 2020. As we continue to see investments in decarbonized power grow, how can the federal permitting process make sure utilities are able to survive surges in demand and evening peaks?

The federal permitting process can be used to incorporate utilities’ needs in delivering a resilient energy grid in the face of rapidly changing energy sources and extreme weather events, but federal permitting officials must first recognize what those needs are before they can integrate them into the core components of the permitting process.

Assessment of Existing Grid Needs

The American grid consists of more than 3,000 utilities, the needs of each varying dramatically. Even so, extensive regional and national efforts and studies have been taken to identify and prioritize grid resiliency needs in the face of catastrophic weather events and to accommodate the changes in energy sources to reflect more intermittent, renewable energy sources. The federal government, in cooperation with state and local governments, utility owners and operators, emergency managers, and various stakeholders, has developed a number of studies, reports, and models that identify various grid needs and vulnerabilities, including:

- Ongoing updates to the Department of Energy’s (DOE) State and Regional Risk Profiles ([State and Regional Energy Risk Profiles | Department of Energy](#));
- Federal Energy Regulatory Commission’s (FERC) grid reliability assessments, including those held jointly with the North American Electric Reliability Corporation (NERC);
- DOE’s Integrated Multi Scale Sector Modeling Project, which is designed to capture dynamic interactions among climate, energy, water, land, socioeconomics, critical infrastructure, and other sectors to study vulnerability and resilience under various time and stress scenarios;
- DOE’s North American Energy Resilience Model (NAERM), which enables prediction of the impact of threats, evaluation and identification of effective mitigation strategies, as well as associated dependencies on natural gas, and other critical energy infrastructures; and
- DOE’s 2020 National Electric Transmission Congestion Study, which found that transmission congestion conditions did not merit designation of National Corridors, which are reserved for geographic regions where electricity transmission limitations are adversely affecting American citizens, but DOE did recognize critical issues beyond transmission constraints and congestion as currently defined, primarily those posed by increasing resilience needs.

While DOE did not find congestion conditions merited designation of National Corridors in their 2020 National Electric Transmission Congestion Study, the [Natural Resources Defense Council's Sustainable FERC Project](#) that same year found 245 clean energy projects in advanced stages of development were withdrawn between 2016 and 2020, in the Midcontinent Independent System Operator's grid in the same areas where the grid operator's maps showed extreme congestion. Power generators typically pay for the interconnection lines to transport their power to the grid, but since many of the existing long-distance, high voltage interstate power lines are too congested to allow for new connections, those developers are being charged for grid upgrades to support their power transmission. This especially impacts renewable energy projects, as developers are limited to sites where the resource is best, and available grid connections are limited and have not been upgraded – in fact, GAO reported last year that 70 percent of the country's transmission lines and transformers are more than 25 years old (GAO-21-346).

As reported in ["Grid congestion a growing barrier for wind, solar developers in MISO territory,"](#)

Invenergy Senior Vice President Kris Zadlo noted that there were 27 projects submitted into MISO's February 2017 west interconnection cluster representing 3,421 megawatts. MISO studies initially showed the need for about \$3.4 billion in transmission upgrades for those projects, coming out to about \$1 million per megawatt to interconnect. "To put this value in context, you are almost paying as much to interconnect as you are to build a renewable resource," Zadlo said, and all but two of the projects were ultimately canceled.

"There's a breakpoint where bearing those costs makes the renewable project unprofitable and you just have to drop out of the queue," Zadlo said. "Transmission is essentially highways or roads in the sky — if you wanted an Amazon distribution center in your community, you wouldn't make Amazon pay for the highway — you would build a highway to attract Amazon and all the other industries that would come with it."

In spite of the clear need for upgrades and increased resiliency measures to support our nation's grid, the results of such nationwide and regional studies and assessments are left out of most core permitting processes.

#### Integration of Grid Needs into the Permitting Process

In light of all the existing information and completed and ongoing studies regarding national and regional grid needs, federal agencies have the opportunity to incorporate the findings of these studies into core aspects of the permitting analyses. Utilities' grid resiliency needs and the severity of those needs on national and regional scales should be incorporated directly into the Purpose and Need statement when conducting National Environmental Policy Act (NEPA) analyses for individual proposed energy generation or transmission line projects. This statement is important in that it determines the scope and range of alternatives for NEPA review. While energy regulatory agencies may include aspects of the applicant's purpose in proposing a transmission or energy generation project, such as meeting a power purchase agreement or state legislated renewable energy goal, cooperating and participating Federal agencies are under no such obligation to limit their NEPA review with such constraints in mind when determining reasonable alternatives on a project by project basis, or when determining what constitutes alternatives that are reasonable in overall scope/cost of the proposed project, as per USACE 404(b)(1) guidelines.

Federal agencies should instead coordinate with project developers, particularly during the pre-application processes established by many agencies, and cross-reference already identified critical needs for grid resiliency with the interconnection queue, where there are established wait lists of privately financed renewable energy projects seeking connection to the grid. This information can then be incorporated into the NEPA purpose and need, range of alternatives, and be used to better inform the public and decisionmakers about consequences should various alternatives or no action be taken.

Where grants or loans may be available to support grid enhancements necessary for new energy sources to be able to connect to the grid, lead agencies' permit applications can be used as an initial screening criterion by those loan programs, to reduce the administrative burden on developers and to help the federal government proactively engage with developers proposing projects that meet the goals and objectives of those loan programs.

In addition, information about proposed projects already waiting in interconnection queues on a regional basis can be used by federal agencies for resource planning for their permitting offices now and for the future. The mismatch between federal permitting staff availability and this waitlist of private investment in renewable energy development and transmission lines, including those with energy storage to support grid flexibility and resilience, can best be seen by the Department of the Interior's establishment of a prioritization policy<sup>1</sup> that leaves funded renewable projects currently waiting years to begin the federal environmental review process (for example, [Bonanza Solar Project](#)). The Renewable Energy Coordination Offices (RECOs) recently authorized by Congress in the Energy Act of 2020 may assist the Bureau of Land Management (BLM) better manage its resources, but it remains to be seen how quickly these "on hold" projects will remain waiting to begin federal review, or how similar issues across other Federal agencies will be resolved for these same BLM-led projects. This current status quo of apply, pay the application fee, and wait for Federal staff availability indefinitely may inadvertently lead to projects' cancellation in regions that have critical needs for those projects, as investors move on to other projects that are not waiting for staff to begin review for a longer period of time than the review itself is projected to require. Instead, federal agencies should provide an explicit set-aside in their budget proposals to OMB and Congress, for permitting staff to ensure capacity to handle the projected workload, and designate those funds solely to permitting responsibilities and/or permitting process improvements.

2. As the President & CEO of The Permitting Institute, I know that you have invested heavily traveling the country and highlighting opportunities for projects to apply to be covered projects under the Permitting Council. Through this outreach, what does Congress need to know so we ensure the nation is properly emphasizing this opportunity?

During my time engaging with various federal, state, and local government officials, Tribal representatives, industry, and non-governmental organizations across the country, I learned how important outreach in the field is to ensuring federal agency leadership and staff (including Council member agencies) at regional and field office locations are familiar with and actively promoting the benefits offered by FAST-41 coverage to project sponsors, as well as at Headquarters. Active

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<sup>1</sup> BLM will "Apply screening criteria to prioritize processing of applications with lesser conflicts over applications with greater resource conflicts..." (43 CFR §2804.25(e)(ii)). Regulations further state that "High-priority applications are given processing priority over medium- and low-priority applications..." (43 CFR §2804.35(a)).

engagement by the Council members (deputy secretary or equivalent) in promoting their roles on the Council and their annual establishment of best practices and review of the results of implementing those best practices to meet the aggressive goals of the Administration and the Infrastructure Investment and Jobs Act.

The existing OMB and CEQ FAST-41 Implementation Guidance requires agencies to advertise and promote FAST-41 coverage to potential project sponsors, but I found many agency staff in the field were unfamiliar with FAST-41 during my travels, even those charged with administering a FAST-41 covered project. To support agencies efforts in educating their staff on what FAST-41 is and how it works to incrementally improve the permitting process for covered and, through best practice identification and implementation, all infrastructure projects, prior to the pandemic the Office of the Executive Director held a virtual training session with federal staff across the country, and had planned on-the-ground sessions regionally so reach field staff and support a forum to discuss benefits realized by fellow staff that have worked on FAST-41 covered projects. Demonstrated support and knowledge of the program and its benefits are an area we identified as a priority workflow for our office and that of the Council Members prior to my leaving the Council.

**Post-Hearing Questions for the Record**  
**Submitted to Bryce Yonker, Executive Director & Chief Executive Officer, Grid Forward**  
**“Strategies for Improving Critical Energy Infrastructure”**  
**Wednesday, October 27, 2021**

1. As we continue to modernize and diversify electrical generation in Arizona, and across the country, we also need to be working towards next generation storage. What are the short- and long-term roadblocks to improving energy storage to meet demand when baseload generation alone is insufficient?

It is hard to call any standalone aspect of our advanced grid a silver bullet to address the increasing demands we have for it but longer duration storage certainly looks as close to anything like it. Flow batteries, traditional and newer forms of pumped hydro, mechanical storage, molten salt, compressed air, and other solutions all show significant promise to get us beyond the four hour duration that lithium ion looks like it will very much play a leading role for. Grid deployments in this area have remained relatively limited to date but its time to significantly accelerate them. A few ideas that would help include:

- Significantly more funding at DOE. The Energy Storage Grand Challenge, Long Duration Storage Shot, deployment funding in the Infrastructure Investment and Jobs Bill and others are a good start but they need say 10X more resources.
- We need to test a wide variety of solutions at scale and then start driving costs down. That will include building out domestic supply chains, helping support operators with more expensive initial deployments and other critical areas. Initial deployments will not be cost effective and that is where federal resources can come in.
- The tax incentives being discussed in the reconciliation package could play a central role in supporting storage deployments as well, though many of those projects will be traditional and proven technologies.
- Cost and benefits of shorter duration storage are starting to take form now with massive growth in lithium ion playing out<sup>i</sup>
- Some states are starting to get active in their investments for grid flexibility including long duration storage. Research projects by EPIC in California and regulator calls for 1GW of storage<sup>ii</sup> are showing the need now for these solutions
- Private money is doing its part -- \$11 billion was invested in energy storage companies in the first three quarters of 2021<sup>iii</sup> and an expected 14GW+ of storage added in the US<sup>iv</sup> from 2021-2024 and up to 20GW installed globally each year by 2024<sup>v</sup>
- Some noteworthy recent funding's mostly within the last few months:
  - ESS in Oregon went public last month and raised over \$300 million for its flow battery solution

- Form Energy raised \$240 million in series D funding in August for its long duration battery storage
- Energy Vault raised \$100 million in series C funding in August for its mechanical storage
- Ambri raised \$144 million in August for its battery solution
- FlexGen raised \$150 million in August for its storage integration capabilities
- EnergyVenue raised \$100 million for series A in Sept for increased production

2. The prevalence of cybersecurity risks to nearly all parts of America's critical infrastructure has been made clear over the past few years. Most notably, in May of this year the Colonial Pipeline ransomware attack impacted 45 percent of the East Coast's fuel supply. Can policies help ensure cybersecurity is embedded in grid infrastructure as a key attribute that protects reliability and resiliency?

Policy can and should be at the core of helping the U.S. ensure that our grid cyber capabilities are world class. As our grid becomes more diverse in its capabilities it inherently holds a wider surface area that we need to ensure is fully protected. Grid Forward advisor, Steve Parker of EnergySec, shared, "By their nature, the advanced grid functions we seek to deploy present new risks, such as cybersecurity. Just as we would not accept new technology that was unsafe, or that failed frequently and unpredictably, we must not deploy solutions that cannot be operated securely. Cybersecurity must be seen as an intentional, required design attribute that enables advanced capabilities to be deployed without threatening the reliability and resiliency we seek to enhance." Some top areas where federal policy and resources can support critical grid cyber security areas include:

- From a Siemens study about a year and half ago. Energy utility operators report that the frequency of attacks has been increasing, with 56 percent having experienced a data breach or outage in the past year, and 54 percent expected an attack on critical infrastructure in the coming 12 months<sup>vi</sup>
- National Security Council issued the *National Cyber Strategy*<sup>vii</sup>, which describes actions that federal agencies and the administration are to take, such as prioritizing risk-reduction across seven key areas, including energy and power, to protect critical infrastructure.
- GAO Electricity *Grid Cybersecurity Report*<sup>viii</sup> early this year "recommended that DOE develop a plan that addresses the key characteristics of a national strategy, including a full assessment of cybersecurity risks to the grid. DOE agreed with our recommendation and, according to DOE officials, the department is updating its plans and assessment."
- More cyber capability funding. The \$600 million in the infrastructure package is a good start but is not enough. The resources there focused for smaller operators and rural communities could not be more appropriately directly. Remembering that cyber capabilities really center around people is another critical aspect –



workforce development resources for cybersecurity professionals are needed at all level of the talent pipeline.

- The DOE office of Cybersecurity, Energy Security, and Emergency Response needs to appoint an assistant secretary and become more fully staffed
3. The Department of Energy's National Labs are a foundational element of innovation for America's grid technologies. You specifically mention the national labs throughout your testimony as undertaking cutting-edge research and demonstrations. What further actions can the federal government take to spur innovation and public-private-partnerships at our National Labs in this area?

The foundational research of the national labs have brought us unbelievable advancements including the internet, the dramatic cost declines in storage, solar and many other areas. One of the most important elements of the lab system is in commercializing innovations or bringing the breakthroughs into the real world. There are pressing grid issues and more needs to be done so the labs can accelerate the commercial engagements in these areas...

- The nearly 100 projects of the Grid Modernization Lab Consortium<sup>ix</sup> have demonstrated the vital capabilities that advanced grid solutions in partnership with industry play for the future of our energy systems
- Pacific Northwest National Laboratory (PNNL) and national lab partners have created GridLAB-D<sup>TM</sup> which is a new power distribution system simulation and analysis tool that provides valuable information to users who design and operate distribution systems, and to utilities that wish to take advantage of the latest energy technologies. It incorporates the most advanced modeling techniques, with high-performance algorithms to deliver the best in end-use modeling<sup>x</sup>
- The North American Energy Resilience Model (NAERM)<sup>xi</sup> is a DOE initiative to develop a comprehensive resilience modeling system for North American energy infrastructure, which includes the electric, natural gas, and communications sectors. This model will provide real-time situational awareness and analysis capabilities for emergency events and make it possible to get ahead of emergencies before they happen
- The National Renewable Energy Laboratory (NREL), in partnership with DOE EERE, has developed a globally unique Advanced Research on Integrated Energy Systems (ARIES) research platform. ARIES is designed to mirror the complexity and scale of real energy systems. Rather than evaluating new clean energy and energy efficiency technologies in silos, ARIES expands the research view to take in the full picture—from consumers to industry to utilities<sup>xii</sup>
- The Smart Grid Investment Grants from 2009-2013 provided \$3.4 billion in projects that directly brought \$7.9 billion of resources to advanced grid capabilities<sup>xiii</sup>. Many utilities accelerated their grid modernization plans by as many as 10 years, and other advanced capabilities were accelerated about 5 years in the market place

- Further funding at DOE for similar efforts would be a great step and many of these aspects are included in the Infrastructure Investment & Jobs Bill and the Energy Act of 2020.

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<sup>i</sup> <https://www.woodmac.com/news/opinion/the-growth-and-growth-of-the-global-energy-storage-market/>

<sup>ii</sup> <https://www.greentechmedia.com/articles/read/the-first-long-duration-storage-procurement-has-arrived>

<sup>iii</sup> <https://mercomcapital.com/clean-energy-reports/>

<sup>iv</sup> <https://www.eia.gov/todayinenergy/detail.php?id=49756>

<sup>v</sup> <https://www.utilitydive.com/news/global-energy-storage-set-to-nearly-triple-in-2021-wood-mackenzie-forecast/607905/>

<sup>vi</sup> <https://www.siemens-energy.com/global/en/news/magazine/2019/cyber-security-ponemon-study.html>

<sup>vii</sup> <https://www.dhs.gov/publication/dhs-cybersecurity-strategy>

<sup>viii</sup> <https://www.gao.gov/products/gao-21-81>

<sup>ix</sup> <https://www.energy.gov/gmi/grid-modernization-lab-consortium>

<sup>x</sup> <https://www.gridlabd.org>

<sup>xi</sup> [https://www.energy.gov/sites/prod/files/2019/07/f65/NAERM\\_Report\\_public\\_version\\_072219\\_508.pdf](https://www.energy.gov/sites/prod/files/2019/07/f65/NAERM_Report_public_version_072219_508.pdf)

<sup>xii</sup> <https://www.nrel.gov/aries/>

<sup>xiii</sup> [https://www.smartgrid.gov/recovery\\_act/overview/smart\\_grid\\_investment\\_grant\\_program.html](https://www.smartgrid.gov/recovery_act/overview/smart_grid_investment_grant_program.html)



Working together to responsibly and economically  
keep the lights on today and in the future.

December 13, 2021

The Honorable Kyrsten Sinema, Chairman  
Subcommittee on Government Operations and Border Management  
U.S. Senate Committee on Homeland Security and Governmental Affairs  
601 Hart Senate Office Building  
Washington, DC 20510

Sent Via Electronic Mail: Mallory\_Nersesian@hsgac.senate.gov

Dear Chairman Sinema:

Thank you for the opportunity to appear before the Subcommittee on Government Operations and Border Management on October 27, 2021, to testify at the hearing entitled "Strategies for Improving Critical Energy Infrastructure."

Pursuant to the Rules of the Committee on Homeland Security and Governmental Affairs, attached please find my response to your post-hearing question submitted for the record, as well as my proposed corrections to my hearing transcript.

Thank you again for your time and for allowing me the opportunity to deliver my testimony before the Subcommittee. Please contact me if there is further information that you may need.

Sincerely,

A handwritten signature in black ink, appearing to read 'Lanny', is written over a horizontal line.

Lanny Nickell  
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Chief Operating Officer  
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cc: The Honorable James Lankford, Ranking Member  
Subcommittee on Government Operations and Border Management

Attachments

**Post-Hearing Question for the Record****The Honorable Kyrsten Sinema**

- 1. I agree with your assessment that the communication and coordination between the gas and electric industries can be improved. You also mentioned the need for the natural gas industry to take actions to improve fuel assurance during extreme weather events. Can you provide a few specific examples of concrete steps the natural gas industry could take to achieve this?**

The Federal Energy Regulatory Commission (FERC), the North American Electric Reliability Corporation (NERC) and NERC's regional entities issued a joint final report on November 16, 2021, examining the impact the February 2021 severe cold weather event, also known as also known as Winter Storm Uri, had on the reliability of the bulk electric system in Texas and other parts of the South Central United States. With regard to natural gas production, supply and delivery during Winter Storm Uri, the final report states: "Unplanned outages of natural gas wellheads due to freeze-related issues, loss of power and facility shut-ins to prevent imminent freezing issues, beginning on approximately February 7, as well as unplanned outages of natural gas gathering and processing facilities, resulted in a decline of natural gas available for supply and transportation to many natural gas-fired generating units in the South Central U.S. Once natural gas supply outages began at the wellhead, they rippled throughout the natural gas and electric infrastructure, causing processing outages and reductions, pipeline declarations of Operational Flow Order (OFO)s and force majeure, and outages and derates of natural gas-fired generating units." The full report is available at <https://www.ferc.gov/media/february-2021-cold-weather-outages-texas-and-south-central-united-states-ferc-nerc-and>.

Consistent with key recommendations of the FERC and NERC joint final report, the natural gas industry should develop and maintain cold weather preparedness plans for all natural gas producing, processing and transportation facilities needed to assure a critical amount of fuel supply. Additionally, the gas industry should identify where facility improvements are needed to better assure proper performance of these facilities during extreme cold weather conditions and undertake efforts to make associated, prudent investments. If these steps are taken, the kind of unplanned outages experienced during Winter Storm Uri are much less likely to re-occur in future cold weather events, thus limiting the downstream impacts that potentially lead to interruption of both gas and electric service.

In addition to the FERC and NERC joint inquiry and final report, the North American Energy Standards Board (NAESB), an industry forum for the development and promotion of standards which will lead to a seamless marketplace for wholesale and retail natural gas and electricity, re-activated its Gas Electric Harmonization Committee in June 2021 to solicit comments regarding the potential need for additional harmonization efforts between gas and electric standards. The ISO/RTO Council (IRC), which comprises the nine North American independent system operators and regional transmission organizations, submitted a number of recommendations to increase overall gas reliability and market efficiency, including better alignment of electric gas scheduling, particularly over the weekend, and modifying scheduling requirements to reflect actual gas delivery.

While it is important for the gas industry to collectively undertake the actions discussed above, proper coordination with the electric industry during these efforts will better assure the most effective outcomes.